3.0 AFFECTED ENVIRONMENT FOR PROPOSED ACTION AND ALTERNATIVES

This chapter describes the affected environment associated with the Proposed Action and alternatives. The affected environment is the physical area that bounds the environmental, sociological, economic or cultural feature of interest that could be impacted by the Proposed Action or alternatives. When preparing this DEIS, the best available information was used to describe existing environments and Proposed Action facilities and activities. The information serves as a baseline from which to identify and evaluate environmental changes resulting from the Proposed Action and Alternatives. The baseline conditions, for the purposes of analysis, are the conditions that currently exist.

In the following sections, the term "project area" refers to the area that encompasses the proposed ROW and associated Proposed Action components, as well as the area immediately adjacent to the proposed facilities. The study area, or Region of Influence (ROI) varies depending on the resource being analyzed and the predicted locations of direct and indirect impacts from the Proposed Action or Alternatives. The Area of Potential Effect (APE), as used in the Archeological Resources and Historic Properties section, is synonymous with the project area.

Based on consideration of the issues raised during the public scoping process, as well as guidance from NEPA, the following critical elements of the environment are considered in the evaluation of the Proposed Action and alternatives.

- Geologic Resources
- Soil Resources
- Water Resources
- Vegetation Resources
- Wildlife Resources
- Land Use
- Areas of Critical Environmental Concern, Wilderness and Other Special Use Areas
- Recreation
- Air Quality
- Noise
- Visual Resources
- Socioeconomics
- Environmental Justice
- Hazardous and Solid Waste
- Paleontological Resources
- Archeological Resources and Historic Properties

The following resources do not occur in the project area and are not addressed further in this DEIS.

Wild and Scenic Rivers – There are no federally designated Wild and Scenic Rivers in the project area.

Wild Horses and Burros – There are no wild horses and burros present in the project area.

Prime and Unique Farmlands – There are no prime and unique farmlands in or near the project area.

Indian Trust Assets – There are no Indian Trust Assets in the project area.

3.1 GEOLOGIC RESOURCES

The ROI for geologic resources includes the area adjacent to the proposed ROW, nearby off-site areas subject to disturbance from the Proposed Action or alternatives, and those areas beneath new facilities that would remain inaccessible for the life of the Proposed Action.

3.1.1 Geology

3.1.1.1 Physiography and Topography

The ROI is located within Kane Springs and Coyote Spring Valleys. Kane Springs Valley is an elongated north-northeast/south-southwest trending valley which extends from Coyote Spring Valley, at the southwestern end near Highway 93, to the northeastern end near Elgin. Kane Springs Valley is approximately 40 miles long, with an average width of approximately 8 miles. The floor of the valley slopes south-southwest from an elevation of approximately 4,400 feet on the northeast between the northerly piedmonts of the Meadow Valley and Delamar mountains toward the mouth of the valley, where the elevation is approximately 2,600 feet. The Delamar Mountains to the northwest reach 7,720 feet, while Meadow Valley Mountains to the southeast are considerably lower, with a maximum elevation of 5,676 feet.

The southwestern portion of the ROI is located in the Coyote Spring Valley, which is bounded by the Sheep Range to the west and the Meadow Valley and Arrow Canyon Mountains to the east. The Coyote Spring Valley trends north-south and extends about 37.5 miles from Kane Springs Valley to Hidden Valley. The basin is roughly 8 miles wide.

3.1.1.2 Stratigraphy and Geologic History

The geology of Nevada is the result of millions of years of activity between the North American Plate and various oceanic plates. The activities resulting from historical plate tectonics of folds, thrust faults, strike-slip faults, normal faults, igneous intrusions, volcanism, metamorphism and sedimentary basins have developed the unique geologic characteristics of the region (Page et al. 2003, 2005).

Most of the State of Nevada, as well as portions of adjacent states, is part of an area known as the Great Basin. The eastern portion, in which the project area lies, is characterized by Paleozoic aged - older than 270 million years before present time (or 270 Ma) - alternating sedimentary sequences dominated by clastic rocks with minor amounts of limestone or dolomite, or by carbonate rocks with minor amounts of clastic rocks. The area dominated by carbonate rocks is known as the Carbonate-Rock Province that lies mostly in eastern Nevada and western Utah. Generally, the overall thickness of the carbonate-rock sequences (approximately 5,000 to nearly 30,000 feet) exceeds that of the clastic-rock sequences (Harrill and Prudic 1998).

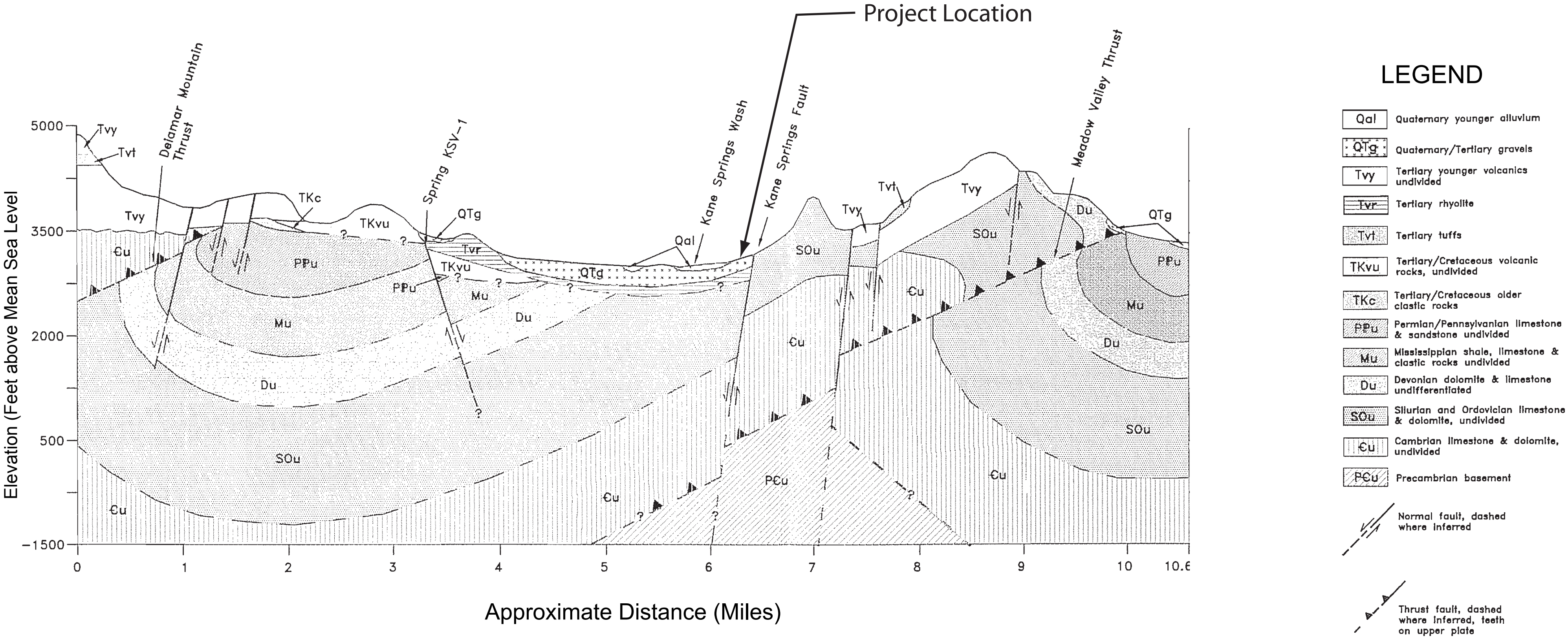
The ROI is also located in the Basin and Range Physiographic Province, characterized by north-to-northeast trending mountain ranges separated by valley basins filled with sediments derived from mountain front erosion. The Basin and Range topography seen today developed during the late Cenozoic Era: approximately 20 Ma. Mountain ranges were uplifted and eroded during this period, resulting in the alluvial sedimentary deposits that fill the resultant basins. Lakebeds and playa deposits were eventually formed as the climate became dryer following the end of alpine glaciation during the late Pleistocene epoch (approximately 10,000 years ago).

On a local scale, Kane Springs Valley is dominated by thick sequences of folded and faulted Paleozoic carbonate rock, intruded and overlain by Tertiary (older than 12 Ma) volcanic rocks and basin fill (Burbey 1997). Most of these volcanic rocks are ash-flow tuffs, which form thin, widespread planar sheets of brittle rock (LVVWD 2001). The carbonate rocks are composed primarily of limestone and dolomite containing varying amounts of silt with interbedded shale (HydroSystems 2000). Carbonate rocks are highly susceptible to dissolution by groundwater. Such dissolution can result in systems of fissures, caves and eventually karst topography.

Several volcanic episodes occurred in the region during the Tertiary period, producing calderas that are discernable today (Noble 1968; Novak 1984, 1985). The Kane Springs Wash Caldera Complex is located in the western central part of the Kane Springs Valley. The caldera complex contains rhyolitic and basaltic flows that are likely to be many thousands of feet thick (Noble 1968; Novak 1984, 1985).

Surficial or overlying basin fill sediments in Kane Springs Valley are 500 to 1,000 feet thick and are composed principally of fine-textured sediments (silt and clay) across much of the basin, except where immediately adjacent to the basin margins in areas of more coarse-textured sediments. These basin fill deposits are characterized as unconsolidated to semi-consolidated fine to coarse clastic material derived from the erosion of the surrounding mountains of predominately volcanic origin (CH2MHILL 2006; HydroSystems 2000). Lithologic logs from boreholes drilled near the mouth of the basin revealed predominantly microcrystalline carbonate rock (dolostone and limestone), quartzite and clay beneath the basin fill (URS 2006b).

A geologic cross-section of the structural features associated with the Kane Springs Wash Caldera Complex and overall geologic setting of the Kane Springs Valley (prepared by CH2MHILL) is shown in **Figure 3-1.** The cross-section shows the Quaternary/Tertiary gravels beneath Kane Springs Wash and adjacent to the Kane Springs Fault. Beneath the basin fill, layers of undetermined thickness consist of Tertiary rhyolite, Silurian limestone and Cambrian limestone and dolomite.



Horizontal Scale: 1 inch = 5280 Feet
Vertical Scale: 1 inch = 1500 Feet
Vertical Exaggeration = 3.2 Times

Geologic data used to construct cross section by Tschanz and Pampeyan, 1956–1958

Source: Hydrosystems, Inc., 2000

Figure 3-1
Geologic Cross-Section

Kane Springs Valley
Groundwater Development Project

Nearby basins, such as those in the Coyote Spring area, are also underlain by older carbonate rocks (Burbey 1997). Carbonate rock has been estimated to be more than 16,000 feet thick in the Sheep Range area of the western part of the Coyote Spring Valley (URS 2006b). Such carbonate rocks, which are highly fractured and laterally/vertically continuous, are the primary groundwater medium (water-bearing rocks) in the area and provide the principal means of inter-basin groundwater flow (CH2MHILL 2006). Groundwater flow through fractured carbonate rock and local hydrogeology is discussed further in Section 3.3.3 - Groundwater Resources.

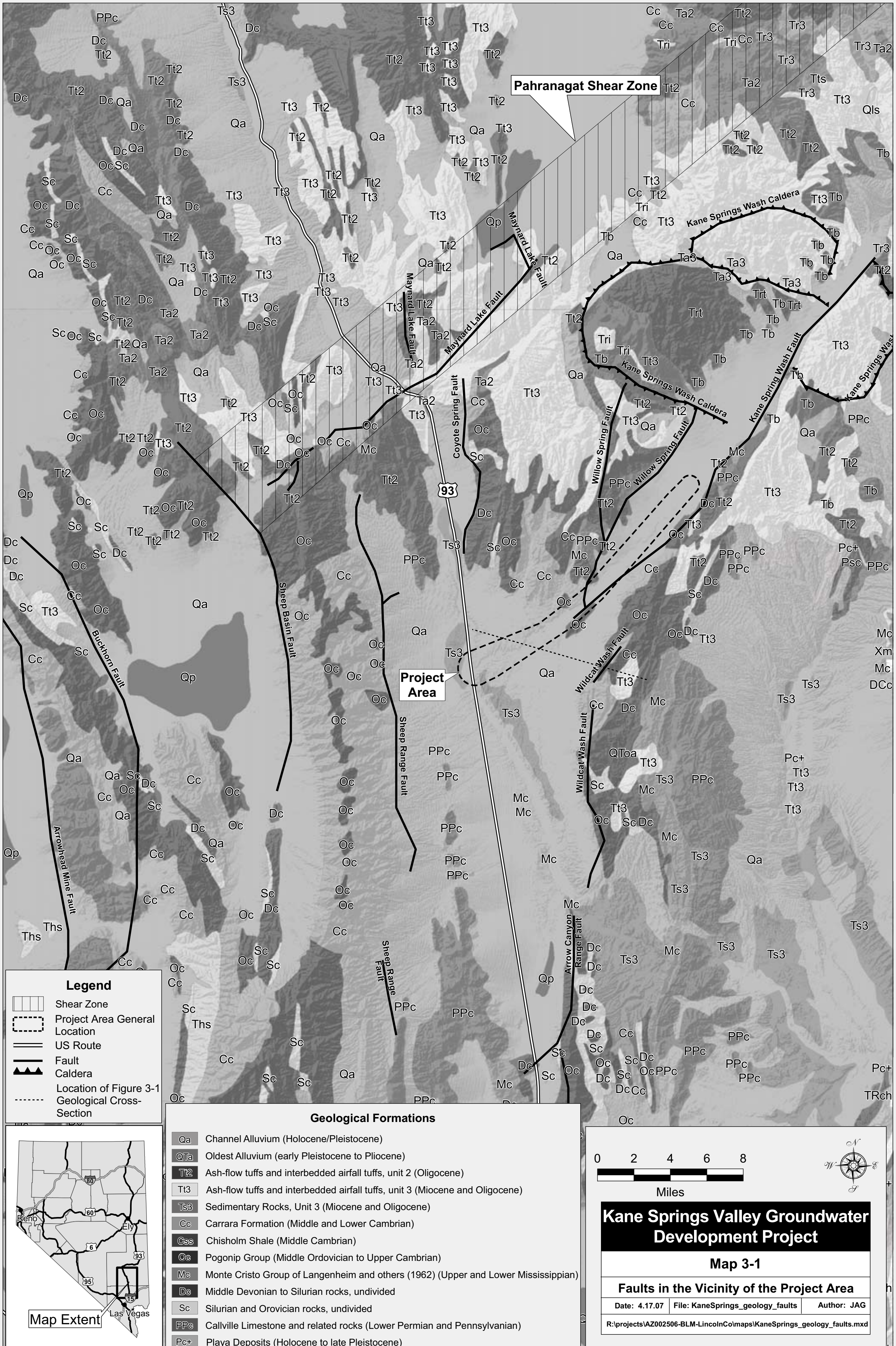
3.1.1.3 Structural Geology

Within the Basin and Range Physiographic Province, the continental crust is continually extending and shearing in response to the motion between the Pacific and North American Plates. This extension results in normal faults that further result in down-thrown blocks (basins), uplifted blocks (mountains), and tilted blocks (combination-mountain and basin) (dePolo et al. 2000). As opposed to normal faults, which involve vertical movement of the crust due to extension, strike-slip faults generally involve no vertical motion, but instead are associated with lateral motion of the crust. Oblique-slip faults are faults in which blocks of rock slip up or down and then past each other diagonally.

There were three dominant structural events that shaped this region. These events include, from the oldest to the most recent, the Sevier orogeny, the Laramide folding and faulting, and the Basin and Range faulting. The Sevier orogeny resulted in the folding, uplift and eastward thrusting of Paleozoic sedimentary rocks. The Laramide faulting resulted in low-angle faults that moved Paleozoic rocks eastward and was also part of a period of uplift, intrusion and compression (ENSR 2004). Basin and Range faulting produced the north-south trending mountain ranges and basins by large-scale movement of crustal blocks (ENSR 2004). Faulting in the Basin and Range Province continues today.

The younger late Cenozoic Basin and Range episode blocked out the present topography into north-striking ranges and intervening basins, which were created by north-striking normal faults. The Basin and Range episode faults in most places obscure the faults and fractures of the older middle Cenozoic episode. Because these faults and the parallel fractures formed by them are recent, they can remain open as conduits for groundwater (LVVWD 2001).

The Pahranagat Shear Zone is located along the northwestern side of the southern Delamar Mountains and continues southwest. It is a left-lateral strike-slip transfer fault zone which connects at both ends with northeast-striking normal faults. This zone, exposed in the Pahranagat Range, forms the western boundary of Pahranagat Valley and is composed of distinct parallel faults including the Arrowhead Mine Fault, Buckhorn Fault and the Maynard Lake Fault. **Map 3-1** identifies faults that occur in the vicinity of the project area. Northeast-southwest trending lineaments have also been mapped in the Arrow Canyon Range and have been identified as deep-seated structural anomalies which may serve as conduits for regional groundwater flow (McBeth 1986, as cited in Kirk and Campana 1990). The northern boundary of the Kane Springs and Coyote Spring hydrographic areas along the Delamar Mountains coincides with the southern extent of the Pahranagat Shear Zone.



Pahranagat Shear Zone
Kane Springs Wash Caldera
Maynard Lake Fault
Coyote Spring Fault
Willow Spring Fault
Kane Spring Wash Fault
Sheep Basin Fault
Sheep Range Fault
Buckhorn Fault
Arrowhead Mine Fault
Wildcat Wash Fault
Arrow Canyon Range Fault
Project Area
93
Legend
Shear Zone
Project Area General Location
US Route
Fault
Caldera
Location of Figure 3-1 Geological Cross-Section
Map Extent
Reno
Ely
Las Vegas
80
60
6
93
95
15
Geological Formations
Qa Channel Alluvium (Holocene/Pleistocene)
QTa Oldest Alluvium (early Pleistocene to Pliocene)
Tt2 Ash-flow tuffs and interbedded airfall tuffs, unit 2 (Oligocene)
Tt3 Ash-flow tuffs and interbedded airfall tuffs, unit 3 (Miocene and Oligocene)
Ts3 Sedimentary Rocks, Unit 3 (Miocene and Oligocene)
Cc Carrara Formation (Middle and Lower Cambrian)
Css Chisholm Shale (Middle Cambrian)
Oc Pogonip Group (Middle Ordovician to Upper Cambrian)
Mc Monte Cristo Group of Langenheim and others (1962) (Upper and Lower Mississippian)
Dc Middle Devonian to Silurian rocks, undivided
Sc Silurian and Orovician rocks, undivided
PPc Callville Limestone and related rocks (Lower Permian and Pennsylvanian)
Pc+ Playa Deposits (Holocene to late Pleistocene)
0 2 4 6 8
Miles
N
E
W
S
Kane Springs Valley Groundwater Development Project
Map 3-1
Faults in the Vicinity of the Project Area
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Author: JAG
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The project area is near the Willow Springs Fault and Kane Springs Wash fault zone, which is an area of extensive tectonic activity. The two wells drilled by the LCWD at the south end of the Kane Springs Valley Hydrographic Basin were sited near the point where the Willow Springs fault merges with the Kane Springs Wash fault zone (Swadley et al. 1994). The Willow Springs Fault is a normal fault that bounds the eastern flank of the Delamar Mountains and forms the topographic boundary on the east side of the Kane Springs Valley. The Kane Springs Wash fault zone, located east of the project area, is a left-lateral oblique-slip fault zone (Swadley et al. 1994) affecting both Tertiary (recent) and Paleozoic (older) rocks. Most, if not all, of the motion along this fault zone is considered part of the Basin and Range extensional episode.

3.1.2 Seismicity

The Basin and Range Province is one of the most seismically active regions in the United States. Nevada is the third most active seismic area in the United States, after California and Alaska. Over the last 150 years, an earthquake of Richter scale magnitude 7 or greater has occurred in Nevada approximately every 30 years (NBMG 2006).

Between 1852 and 2006, eight earthquakes of a magnitude greater than 5 have been recorded in the region (UNR 2006). The largest earthquake recorded in the area was a magnitude 6.1 event that occurred in the Clover Mountains in 1966. The most recent earthquake in the region, recorded on June 20, 2006, was a magnitude 4.4 event that occurred near the Town of Alamo. According to recent probabilistic acceleration maps developed by the USGS for southern Nevada, the project area is located in an area with very low potential for earthquakes and associated ground acceleration (USGS 2006).

3.2 SOIL RESOURCES

The ROI for soil resources includes the area adjacent to the proposed ROW and nearby off-site areas subject to disturbance from the Proposed Action or alternatives and those areas beneath new facilities that would remain inaccessible for the life of the Proposed Action.

The ROI is located within Kane Springs Valley and Coyote Spring Valley, adjacent to Kane Springs Road. Landforms within the ROI include drainages associated with the Kane Springs Wash and Pahranagat Wash, fan remnants and piedmont slopes originating from the Delamar Mountain range on the north, and the Meadow Valley Mountain range on the south. Most of the soils located in the ROI are from 12 soil series. Information regarding soil distribution and type was derived from the *Soil Survey Lincoln County, Nevada, South Part* published by the USDA Natural Resource Conservation Service (NRCS 2000).

Soil map units (areas dominated by one or more types of soil) located on fan remnants in the Kane Springs Valley and Coyote Spring Valley include Weiser-Tencee (Map Unit #1001), Tencee-Weiser (1010), Kurstan-Tencee (1020), Kurstan-Knob Hill (1021), Knob Hill-Arizo (1052), and Alko-Arizo (1170). These soils are mostly located within alluvial fans and terraces, and include both shallow and deep soils that are well to excessively drained. Slopes in the ROI are level to gently sloping.

Arizo (1031) and Arizo-Bluepoint (1030) soil associations are found within the drainages of the Kane Springs Wash and Pahranagat Wash. Bluepoint soils are very deep and somewhat excessively drained. Arizo soils are primarily located in drainages that flood occasionally; normally between March and September during large precipitation events.

On the eastern end of the ROI, Geta-Arizo (1100) soil associations are found on piedmont slopes on the north side of the Meadow Valley Mountain Range. In this same area, Canutio-Arizo (1360) soil associations are found southeast of Kane Springs Road. Approximately 1 mile northwest of KPW-1, the Akela-Rock Outcrop (1040) soil association is found on the south side of the Delamar Mountain Range near Kane Springs Road. Immediately south of KPW-1, the St. Thomas-Chinkle-Rock Outcrop (1060) soil association is present on the north side of the Meadow Valley Mountain Range. Each soil series is described in **Table 3-1**.

Table 3-1
Soil Series Descriptions[1]

Name	Location	Slope (%)	Depth	Drainage	Wind Erodibility Group[2]	Surface Texture
Akela	Mountains	15 to 20	Shallow	Well drained	5	Very cobbly sandy loam
Alko	Fan remnants	0 to 15	Shallow	Well drained	2-4	Gravelly sandy loam
Arizo	Drainageways and stream terraces	0 to 8	Very deep	Excessively drained	4	Very cobbly loamy sand
Bluepoint	Dunes	0 to 15	Very deep	Somewhat excessively drained	2	Loamy fine sand
Canutio	Alluvial fans, fan remnants, inset fans	0 to 8	Very deep	Well drained	4-5	Gravelly sandy loam
Chinkle	Mountains	8 to 50	Very shallow	Well drained	5	Very gravelly very fine sandy loam
Geta	Inset fans, stream terraces, fan skirts	0 to 8	Very deep	Well drained	1-4	Very fine sandy loam
Knob Hill	Inset fans	2 to 4	Deep	Somewhat excessively drained	2-5	Loamy sand
Kurstan	Fan remnants	2 to 15	Very deep	Well drained	4	Gravelly sandy loam
St. Thomas	Mountains	15 to 20	Very shallow	Well drained	5-8	Extremely stony fine sandy loam
Tencee	Fan remnants	2 to 30	Shallow	Well drained	5	Very cobbly, sandy loam
Weiser	Fan remnants	2 to 8	Very deep	Well drained	5	Very gravelly sand loam

Source: NRCS 2000
[1] Soil series are groups of soils that have similar characteristics and fall within specific ranges and limitations. They are the lowest category of soil taxonomy and are concepts that represent what the soil actually looks like. Soil map units are geographic areas dominated by one or more soil series and can contain small pockets of soils that are very different from the most prevalent soil series.
[2] Wind erosion hazards are rated by the Natural Resources Conservation Service using wind erodibility groups; soils assigned to Group 1 are the most susceptible to wind erosion, and those assigned to Group 8 are the least susceptible.

Soil erosion hazards from water are defined based on specific soil properties including texture, structure, permeability and local site conditions such as slope and surface cover. The National

Resource Conservation Service (NRCS) uses K factors (ranging from 0.02 to 0.69) to indicate the susceptibility of a soil to sheet and rill erosion. The higher the value, the more susceptible the soil is to sheet and rill erosion. Within the ROI, most of the soils have low K factors (ranging from 0.05 and 0.20) and are not very susceptible to erosion. The only exception is the Geta soil series, which has a K factor between 0.24 and 0.43 and is moderately susceptible to water erosion.

Wind erosion hazards are rated by the NRCS using wind erodibility groups, which are made up of soils that have similar properties affecting their susceptibility to wind erosion. The soils assigned to Group 1 are the most susceptible to wind erosion, and those assigned to Group 8 are the least susceptible. Most of the soil series within the ROI are classified in Groups 4 and 5, which are described as moderately erodible. Knob Hill and Bluepoint soils are classified in Group 2, which identifies them as very highly erodible. The Geta soil series is classified in Group 1, which means that they are extremely erodible. These soils are found on fan piedmonts on the eastern end of the ROI.

All soils in the ROI, excluding Geta, Weiser and Kurstan soils, exhibit severe limitations for shallow depth excavation. Shallow depth excavations are trenches or holes dug to a maximum depth of 5 or 6 feet. Depending on the depth to bedrock, slope, and presence of cemented pans, special construction procedures may be required.

Approximately 8 acres of the ROI were burned in the Meadow Valley portion of the Southern Nevada Complex fires in June, 2005. A total of 739,000 acres of land in southern Nevada burned over 19 days, with approximately 148,000 acres of the fire occurring in the Meadow Valley portion of the complex adjacent to Kane Springs Valley. The soils affected by the fire were primarily the Tencee-Weiser association and the Canutio-Arizo association. Very small portions of the Arizo soils and the Kurstan-Tencee association were also affected. Because most vegetation in the burn area has been removed, these areas will exhibit a higher susceptibility to wind and water erosion in the future.

3.2.1 Landslides and Subsidence

Landslides are generally initiated in saturated soil on steep slopes. Slides begin and continue movement on a distinct shear surface that usually forms a relatively impervious layer to the downward percolation of water. This surface may be a bedding plane in solid rock or layers within a soil mantle such as a clay lens. Within the ROI, slopes are primarily level to gently sloping.

Subsidence hazards involve either the sudden collapse of the ground to form a depression or the slow subsidence or compaction of the sediments near the Earth's crust. Carbonate rocks, such as limestone, are highly susceptible to dissolution by groundwater that can result in systems of caves and sinkholes. Caves are underground open spaces formed by dissolution of calcite in the limestone as a result of circulating groundwater. Most caves are thought to form near the water table. A sinkhole is a large dissolution cavity that is open to the Earth's surface. Some sinkholes form when the roofs of caves collapse, others can form at the surface by dissolving the rock downward. Subsidence can also occur following the extraction of large quantities of groundwater; as the pore space within the unconsolidated rock now empty of water is filled with collapsing sediment. No caves or sinkholes have been identified in the ROI; however, numerous caves have been identified throughout eastern Nevada. The regional carbonate aquifer also can be highly fractured in some areas and might contribute to the future formation of cave features.

3.3 WATER RESOURCES

Discussion of water resources is divided into surface water and groundwater. For surface water, the area of delineation is the hydrographic basin, or watershed, which includes the area drained by a stream system and bounded by topographic divides.

For groundwater resources, the area of delineation is defined in terms of 1) groundwater in the underlying rocks or 2) the area of groundwater flow from source areas located either in the bounding mountain ranges or upstream basins toward discharge areas where groundwater is lost to evapotranspiration, discharges to the surface water regime, or flows underground into down-gradient basins.

The ROI for water resources (both groundwater and surface water) includes two separate areas: 1) the area adjacent to the proposed ROW and immediate vicinity and 2) the Kane Springs Valley Hydrographic Basin and adjacent basins including Delamar Valley (#182), Coyote Spring Valley (#210), and Meadow Valley Wash (#205). Nearby basins of interest include Pahranagat Valley (#209) and Muddy River Springs (#219).

3.3.1 Hydrologic Setting

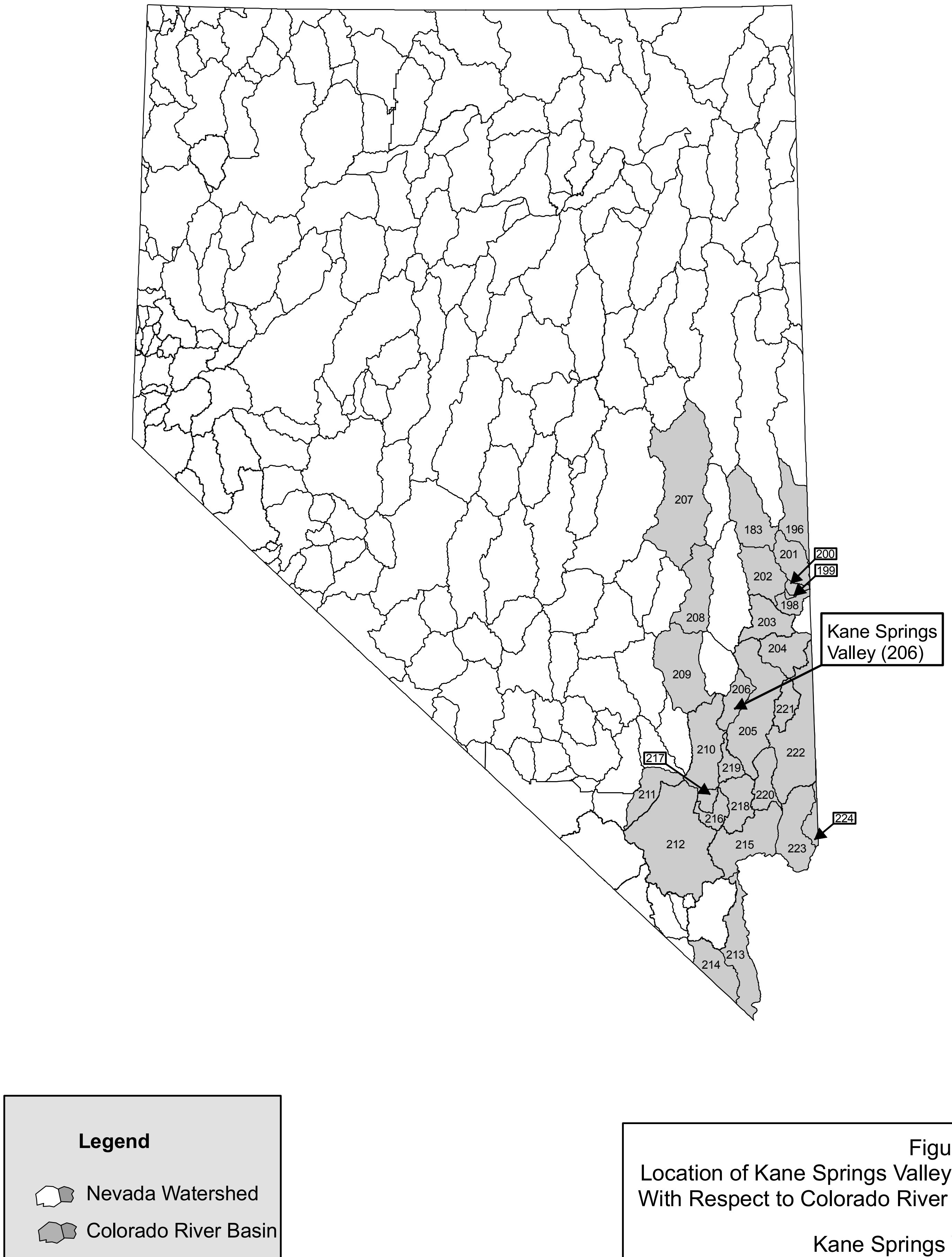
3.3.1.1 Surface Water

The USGS and the Nevada Division of Water Resources have divided the State of Nevada into 14 distinctive hydrologic units called hydrographic regions or basins. Kane Springs Valley is located in the Colorado River Basin Hydrographic Region, which is designated as Basin 13. The 14 principal hydrographic regions are further subdivided into 256 Hydrographic Areas and Sub-areas. The smaller hydrographic areas typically comprise a valley, a portion of a valley, or terminal basin. Kane Springs Valley is located in the Kane Springs Valley Hydrographic Area/Sub-Area (#206) of the Colorado River Basin (**Figure 3-2**).

Map 3-2 shows the Hydrographic Basins adjacent to the Kane Springs Valley Hydrographic Basin. These basins include Delamar Valley (#182) (located upstream to the west), Coyote Spring Valley (#210) (located downstream west and to the south), and Meadow Valley Wash (#205) (located to the east). Nearby basins of interest include Pahranagat Valley (#209) and Muddy River Springs (#219).

3.3.1.2 Groundwater

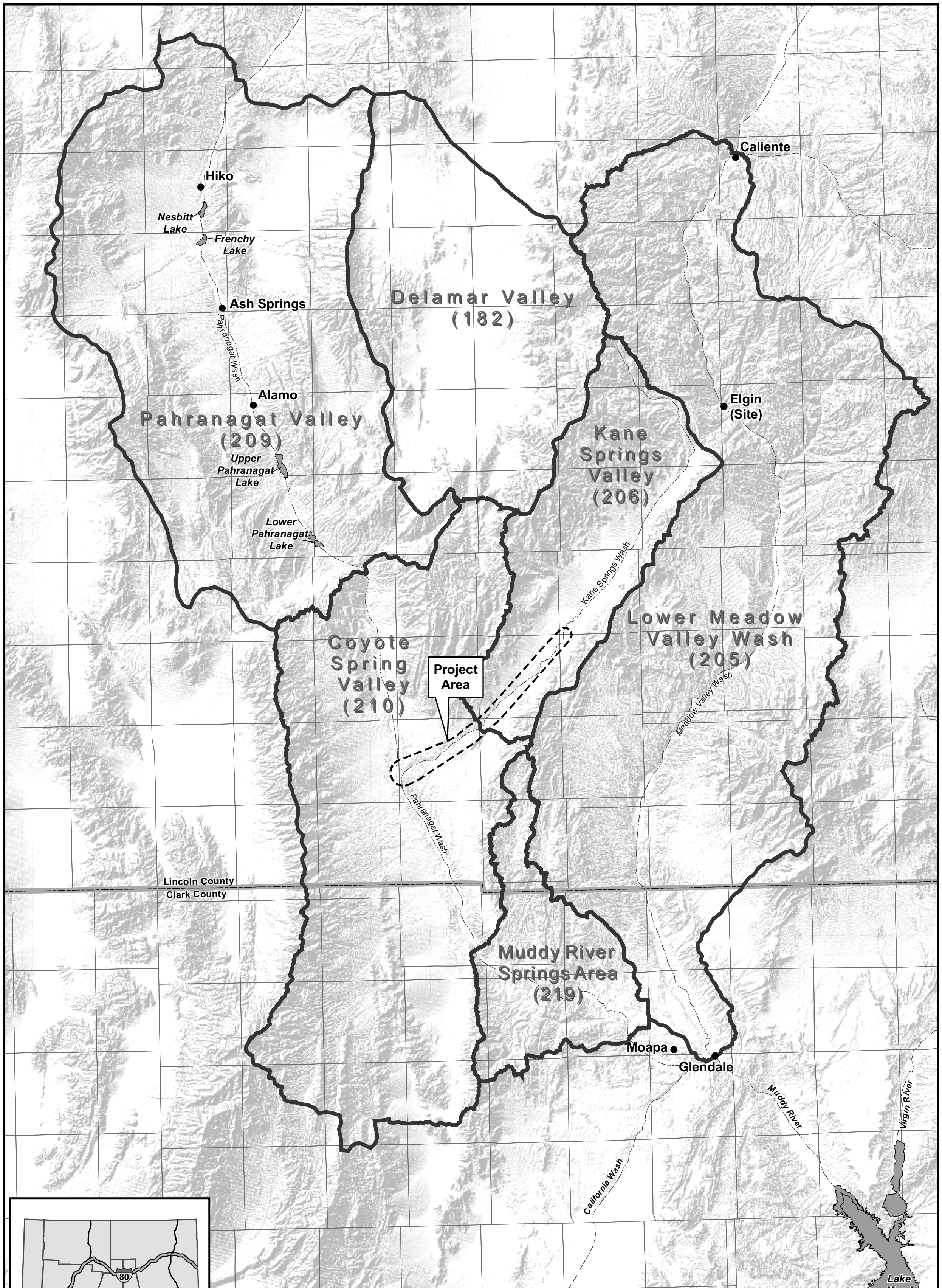
From a groundwater perspective, the Kane Springs Valley is located within the Carbonate-Rock Province, a physiographic region that encompasses the eastern half of the Great Basin and includes areas of eastern Nevada, western Utah, and small parts of Arizona and Idaho (Harrill and Prudic 1998). The spatial relationship between the Kane Springs Valley and the Carbonate-Rock Province is illustrated on **Figure 3-3**.



Source: Nevada Bureau of Land Management, 1999

Figure 3-2
Location of Kane Springs Valley (206)
With Respect to Colorado River Basin

Kane Springs Valley
Groundwater Development Project



Kane Springs Valley Groundwater Development Project

Map 3-2

Hydrographic Basins Adjacent to Kane Springs Valley Hydrographic Basin

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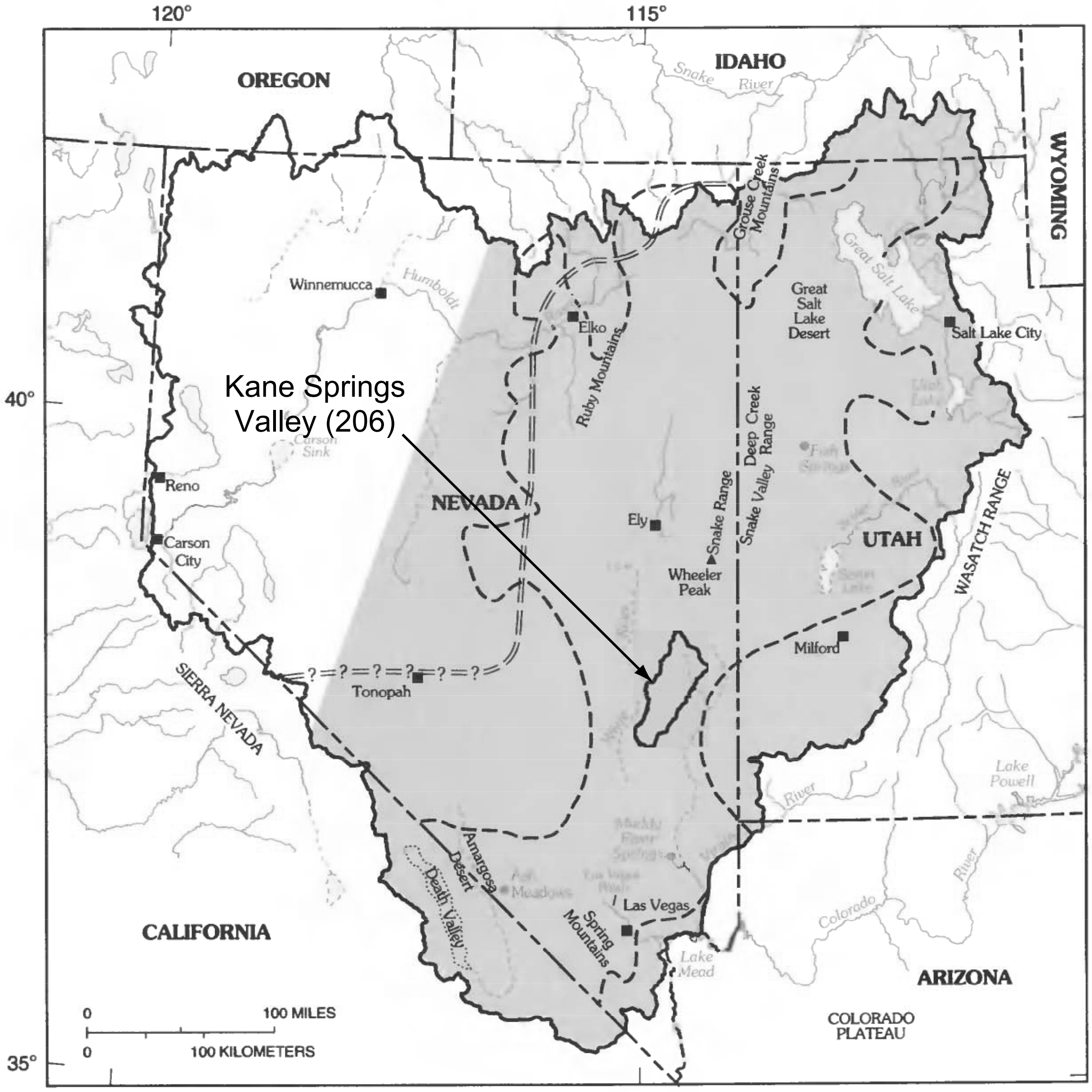


Base modified from U.S. Geological Survey digital linegraph data, 1:1000,000 and 1:250,000, 1987
Albers Equal-Area Conic Projection
Standard parallels 29° 30' and 45° 30', central meridian -114°

Source: Prudic, David E., et al, 1995

Legend

Carbonate-rock province study area—Boundary is approximate

Boundary of Great Basin Regional Aquifer-System Analysis (RASA) study area

Approximate boundary of carbonate-rock province—Within province, at least 80 percent of measured sections are composed of more than 50 percent carbonate rock (from Mifflin and Hess, 1979)

=?== **Approximate boundary of Roberts overthrust belt**—Queried where uncertain

Figure 3-3
Kane Springs Valley in Relation to Carbonate-Rock Province

Kane Springs Valley Groundwater Development Project

Groundwater resources in Kane Spring Valley are part of the regional White River Flow System first described by Eakin (1966). The White River Flow System includes the area within the drainage divides of six valleys drained by the White River in the Pleistocene age and seven adjacent but topographically separated valleys. The six valleys drained by the ancestral White River include White River, Pahroc, Pahranagat, Kane Springs, Coyote Spring, and Upper Moapa Valleys. From the remaining seven valleys, Delamar Valley is located west–northwest of the Kane Springs Valley. **Map 3-3** depicts the general direction of groundwater flow in the carbonate aquifer within the White River Flow System.

3.3.2 Surface Water Hydrology

3.3.2.1 Climate and Meteorology

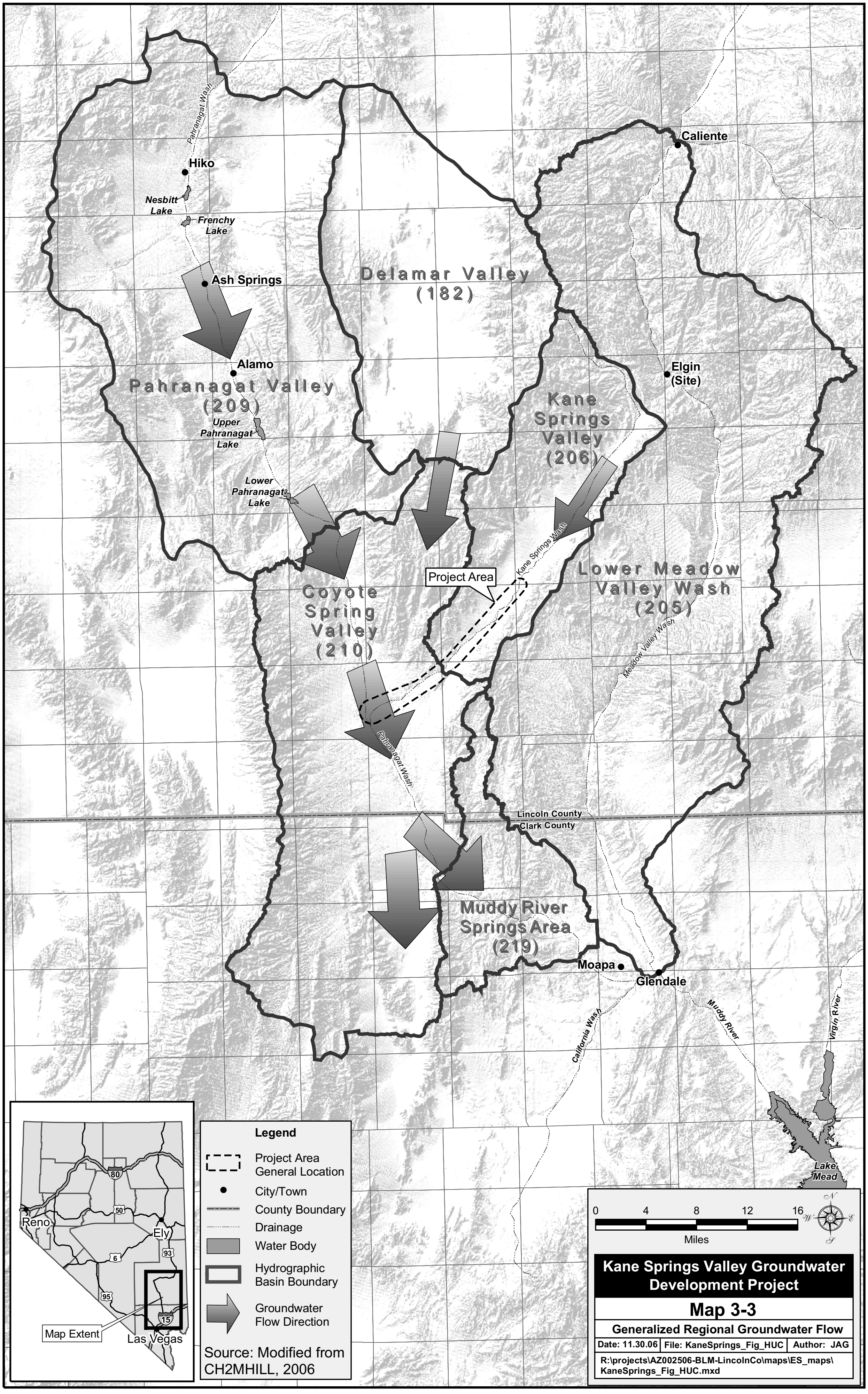
The arid climate of the project area reflects the desert environment that characterizes much of southeastern Nevada. Moderate to hot temperatures, low humidity and minimal annual rainfall typify the region. The region actually has four well-defined seasons, although they differ from the traditional view of seasonal variation. Summers display classic southwest desert characteristics. Daily high temperatures typically exceed 100 degrees Fahrenheit (ºF) with lows in the 70 ºF range. The summer heat is tempered somewhat by the extremely low relative humidity (Eakin 1966).

However, humidity can increase significantly for several weeks each summer in conjunction with moist monsoonal flow from the south, typically during July and August. These conditions can result in desert thunderstorms, which are frequently associated with significant flash flooding and strong downburst winds.

Winters are mild in this region. Afternoon temperatures average near 60 ºF, and skies are mostly clear. Pacific storms occasionally produce rainfall in the southern Nevada desert, but in general, the Sierra Nevada Mountains of eastern California act as effective barriers to moisture. Within the study area, the Delamar Mountains (with elevations reaching 7,720 feet) receive most of the local precipitation. The Clover Mountains, east of the Kane Springs Valley, may affect precipitation patterns within the northeastern portion of the valley (Eakin 1966).

Precipitation falls primarily as rain, typically during two different seasons. Most precipitation comes from the regional winter storm systems derived from west and northwest winds. Precipitation is also likely to occur during the summer as a result of generally localized, short-duration, high-intensity convectional storms (thunderstorms fueled by rising warm air masses). These storms may produce significant rainfall. However, rainfall amounts vary considerably from location to location because of the spatial and temporal variation of these types of storm systems. On the local valley floors, most of the precipitation is lost to transpiration and evaporation (Eakin 1966).

Surface evaporation rates run counter to local precipitation amounts and are relatively high. Snow accumulation is rare in the lower desert region. Flurries are observed once or twice during most winters, but snowfall of 1 inch or more occurs only once every 4 to 5 years. However, freezing temperatures do occur regularly (Eakin 1966). **Table 3-2** presents a historical summary of temperature and precipitation for meteorological monitoring stations near the project area.



Pahranagat Wash
Hiko
Nesbitt Lake
Frenchy Lake
Ash Springs
Alamo
Pahranagat Valley (209)
Upper Pahranagat Lake
Lower Pahranagat Lake
Delamar Valley (182)
Caliente
Elgin (Site)
Kane Springs Valley (206)
Kane Springs Wash
Project Area
Lower Meadow Valley Wash (205)
Meadow Valley Wash
Coyote Spring Valley (210)
Pahranagat Wash
Lincoln County
Clark County
Muddy River Springs Area (219)
Moapa
Glendale
California Wash
Muddy River
Virgin River
Lake Mead
Reno
80
50
Ely
93
6
95
15
Map Extent
Las Vegas
Legend
Project Area General Location
City/Town
County Boundary
Drainage
Water Body
Hydrographic Basin Boundary
Groundwater Flow Direction
Source: Modified from CH2MHILL, 2006
0
4
8
12
16
Miles
Kane Springs Valley Groundwater Development Project
Map 3-3
Generalized Regional Groundwater Flow
Date: 11.30.06
File: KaneSprings_Fig_HUC
Author: JAG
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Table 3-2
Summary of Climatic Statistics in the Vicinity of the Project Area

Location Period of Record	Elevation (feet amsl)	Average Annual Total Precipitation (inches)	Min/Max Avg. Monthly Precipitation (inches)	Min/Max Avg. Monthly Temperature (°F)
Alamo, Nevada 07/02/1948 to 09/30/1962	3,400[e]	4.9	0.07 (Jun) 0.65 (Jan)	20.1 (Jan) 100.3 (Jul)
Pahranagat, Nevada 03/01/1964 to 12/31/2005	3,400[e]	6.4	0.21 (Jun) 0.79 (Mar)	26.5 (Dec) 98.2 (Jul)
Elgin, Nevada (SE) 05/01/1965 to 06/30/1985	3,300[e]	14.1	0.14 (Jun) 2.52 (Mar)	30.7 (Dec and Jan) 100.1 (Jul)
Elgin, Nevada 03/01/1951 to 12/31/2005	3,400[e]	12.5	0.35 (Jun) 2.10 (Feb)	27.8 (Dec) 98.6 (Jul)

[e] Estimated
Source: Western Regional Climate Center 2006
amsl – above mean sea level
SE – southeast

Strong winds can occur during the spring and fall seasons. Winds stronger than 50 miles per hour (mph) are infrequent but can occur with some of the more vigorous storms. Winter and spring wind events often generate widespread areas of blowing dust and sand. Strong wind episodes in the summertime are usually connected with thunderstorms, and are thus more isolated and localized. Prevailing wind direction is typically southwesterly unless associated with a thunderstorm outflow. Surface winds are characterized by prevailing southwesterly winds with an average speed of approximately 10 mph (Eakin 1966).

3.3.2.2 Surface Water Features

With the exception of a few low-flow springs in the foothills of the Delamar Mountains (described in Section 3.3.2.3), there is no surface water in the Kane Springs Valley. Water within the valley occurs below the basin fill material at depths greater than 900 feet bgs. The carbonate aquifer, where pumping would occur under the Proposed Action, begins at approximately 1,400 feet below the surface.

Kane Springs Wash, a normally dry, ephemeral wash, only flows during large precipitation events. Small washes originating in the surrounding Delamar and Meadow Valley Mountain Ranges direct localized surface runoff into Kane Springs Wash, which discharges into the Pahranagat Wash near Highway 93.

Pahranagat Wash, also a normally dry, ephemeral wash, is the principal surface water drainage feature in the Coyote Spring Valley and upstream Pahranagat Valley Hydrographic Area. Pahranagat Wash runs from the north (Pahranagat Valley) to the south and southeast, where it joins Arrow Canyon Wash before joining the Muddy River in the upper Moapa Valley.

There are no perennial surface water features in the upstream Delamar Valley. The only perennial surface water features in the Pahranagat Valley are the Pahranagat and Nesbitt Lakes.

The principal surface water drainage in the Pahranagat Valley is the ephemeral Pahranagat Wash. Several other ephemeral drainages present in Delamar and Pahranagat Valleys usually flow only in response to precipitation events.

The only perennial streams in the region are the Meadow Valley Wash, which is located approximately 30 miles east of the project area, and the Muddy River, which is located approximately 28 miles south of the project area. Meadow Valley Wash is incised through volcanic rocks in the northern part and primarily through basin fill deposits in the southern part of the Lower Meadow Valley Wash Hydrographic Area. Surface water in the Lower Meadow Valley Wash Hydrographic Area is not connected to that of Kane Springs or Coyote Spring Valleys. Meadow Valley Wash trends southward to the Muddy River, which connects to Lake Mead and the Colorado River. South of the 37 degree N latitude, Meadow Valley Wash becomes ephemeral due to pumping, evapotranspiration and infiltration along its course (Burbey 1997). No streamflow data are available for either Kane Springs Wash or Pahranagat Wash. The nearest streamflow measurements were available from two downstream USGS monitoring stations located on the Muddy River near Moapa and Glendale. Streamflow statistics for these stations are summarized in **Table 3-3**.

Table 3-3
Streamflow Statistics for USGS Monitoring Stations

Station Name	Muddy River near Moapa, NV	Muddy River near Glendale, NV
Station Number	9416000	9419000
Drainage Area (mi^2)	3,820	6,780
Period of Record	1944-2005	1950-2005
Mean Annual Flow (cfs)	41.1	42.8
Highest Annual Mean (cfs)	49.6 (1958)	72.2 (2005)
Lowest Annual Mean (cfs)	30.4 (2004)	30.4 (1997)
Maximum Peak Flow (cfs)	5,760 (8/16/1990)	16,400 (8/10/1981)

cfs - cubic feet per second
mi^2 - square miles
NV - Nevada
USGS – U.S. Geologic Survey
Source: USGS 2005a

3.3.2.3 Local Springs

Two types of springs occur in or near the Kane Springs Valley: (1) local springs, which are recharged by precipitation that are not connected to deep underlying groundwater and (2) regional springs, which are partially derived from the carbonate aquifer and are outside of the project area. Local springs are described in this section, while the regional springs are discussed in Section 3.3.3.3.

There are several small springs in the mountains and hills surrounding the Kane Springs Valley. The springs include Willow, Kane, Boulder, Narrow Canyon, Sawmill, and Upper and Lower

Riggs Springs, which are located primarily north and west of the project area (CH2MHILL 2006). These springs are generally low-flowing (less than 0.02 cubic feet per second [cfs]).

A few studies have been performed to identify the characteristics and source of the water discharging from local springs. Eakin (1964) identified six small–yield springs located along the Delamar Range and Meadow Valley Mountains in the Kane Springs Valley area. These springs include Kane, Grapevine, Willow, Cabin and two unnamed springs that issue from, or are adjacent to, volcanic rocks. The first three, along with several others, are discussed by CH2MHILL (2006). Eakin proposed that these springs are supplied by groundwater moving through fractures in the volcanic rocks and that the groundwater is partly perched as the result of either differential permeability among volcanic rock units or faulting.

Based on the more recent isotope studies, local springs, including Upper Riggs, Boulder, Kane, Grapevine and Willow Springs, were found to be recharged by local precipitation, and the water likely travels a relatively short distance before discharging to the surface. Deuterium abundance in water from these local springs contrasts with values of deuterium that correspond to deep, regionally flowing groundwater in the carbonate aquifer systems (CH2MHILL 2006).

3.3.2.4 Surface Water Quality

Section 303(d) of the federal Clean Water Act requires states to develop a comprehensive list of waterbodies that are impaired by point or non-point sources. Section 303(d) also requires that states develop Total Maximum Daily Loads (TMDLs) for all of their impaired waters.

There are no perennial streams within the project area. Within the region, Nevada's 2004 303(d) list of water-quality-limited streams lists the segment of Muddy River from its source to Glendale as impaired from iron, temperature and total phosphorus and the segment from Glendale to Lake Mead as impaired from boron, iron and temperature (NDEP 2005). There are currently no TMDLs associated with Muddy River (NDEP 2005). No other streams in the vicinity of the project area are listed as impaired on Nevada's 2004 303(d) list of water-quality-limited streams.

Nevada's water quality standards, contained in the NAC 445A.118 – 445A.225, define the water quality goals for a waterbody by: 1) designating beneficial uses of the water and 2) setting criteria necessary to protect the beneficial uses. These standards are designated Class A through Class C depending on the degree of degradation from pristine conditions. The designated beneficial uses for the Muddy River include irrigation, watering of livestock, recreation not involving contact with water, industrial supply, propagation of wildlife and propagation of aquatic life (NDEP 2003).

The waters in Pahranagat Lake and Nesbitt Lake, both located within the upstream Pahranagat Valley hydrographic area, are designated as Class C (NAC 445A.126). The beneficial uses of Class C water are municipal or domestic supply (or both following complete treatment), irrigation, watering of livestock, aquatic life, propagation of wildlife, recreation involving contact with the water, recreation not involving contact with the water and industrial supply (NDEP 2003). These lakes are located more than 25 miles north of the project area.

3.3.3 Groundwater Resources

3.3.3.1 Regional Setting

The carbonate-rock aquifer that underlies most of southern Nevada occupies part of what is known as the Carbonate-Rock Province, a physiographic region that encompasses the eastern half of the Great Basin and includes areas of eastern Nevada and western Utah as well as the Death Valley area of California and small parts of Arizona and Idaho (Schaeffer et al. 2005).

Since the early 1960s, the geologic and hydrologic properties of the carbonate-rock aquifer have been the subject of numerous studies by a range of federal, state and local agencies. More recently, a collaborative study has been undertaken to better understand and evaluate regional groundwater flow systems in eastern Nevada as directed by Section 131 of the LCCRDA of 2004. This latter project, known as the Basin and Range Carbonate Aquifer System Study (BARCASS), involves the USGS, the Desert Research Institute (DRI), and the Utah State Engineer's Office. The BARCASS study area includes portions of northern Lincoln County and White Pine County. It does not include the basins discussed in this DEIS.

3.3.3.2 Groundwater Occurrence

Within the regional carbonate aquifer, groundwater occurs in sediments that have filled the valleys to their current elevations (basin-fill deposits) and the underlying rock that also comprises the surrounding hills and mountains. Groundwater is, therefore, stored and conveyed through two principal aquifer systems: 1) saturated, poorly consolidated shallow basin-fill deposits and 2) the underlying fractured sedimentary carbonate (limestone, dolomite) or volcanic (tuff, rhyolite, basalt) rocks (Eakin 1966).

In general, the basin-fill aquifer systems are localized and relatively shallow. Groundwater in these deposits generally flows in directions that coincide with decreasing ground surface elevations. Groundwater can flow among hydrographic areas or basins where the basin-fill deposits from adjacent areas merge (Eakin 1966).

A statewide analysis of shallow inter-basin flows was conducted for the Nevada State Engineer by the USGS in 1971. This study indicated that 35 AFY of groundwater flowed from Pahranagat Valley into the upper Coyote Spring Valley. A small portion of this water was thought to flow eastward into Kane Springs Valley. It was also estimated that groundwater flow from Delamar Valley into Kane Springs Valley was as much as 500 AFY (USGS 1971). More recent studies indicate that higher flow may be occurring through Kane Springs Valley, and these results are discussed in detail in Section 3.3.3.3.1.

The underlying fractured-rock and carbonate aquifer systems, on the other hand, are regional features in which groundwater flows irrespective of the local topography and hydrographic area boundaries. Previous studies have shown that groundwater in the deep fractured-rock systems flows in response to regionally controlled hydraulic gradients driven by regional recharge and discharge areas and is generally not significantly influenced by conditions in the overlying basin-fill aquifer systems (USGS Professional Papers 1409-A through H; Harrill and Prudic 1998). In addition, although individual rock formations are laterally discontinuous and typically highly deformed structurally, the basic rock types are essentially continuous and transcend the boundaries of the hydrographic areas. As a result, it is very difficult, if not impossible, to place lateral bounds around the fractured-rock aquifer systems (Dettinger 1992).

The Kane Springs Valley and Coyote Spring Valley Hydrographic Areas are located within the southeastern edge of the Carbonate-Rock Province (Dettinger et al. 1995, Plume 1996). Within the Carbonate-Rock Province, groundwater flow is strongly influenced by the carbonate-rock aquifers formed during the Paleozoic age. Dominated by limestones and dolomites, the carbonate rocks in this region are brittle and subject to fracturing and, under the right geochemical conditions, can dissolve and form cavities that further enhance the ability of these rocks to store and transmit groundwater. The large geographic area underlain by these carbonate rocks, together with their demonstrated capacity to transmit large volumes of groundwater, is evidence that the carbonate rocks of Nevada comprise aquifer systems of regional scale and significance (Dettinger et al. 1995).

The total volume of groundwater that flows through these aquifers over the entire Carbonate-Rock Province has been estimated by the USGS to be about 1.5 million AFY, which represent only 3 percent of the estimated total precipitation. The study also estimates that approximately 1.2 million AFY are discharged by evapotranspiration, and 211,000 AFY are discharged as regional spring flow from the carbonate aquifer. Within the White River subregion of the Colorado River Basin, the flow through the carbonate aquifer is estimated by the USGS to be approximately 150,000 AFY. Simulated underflow from Pahranagat Valley and adjacent Tikaboo Valley to Muddy River Springs is reported to be 24,000 AFY (Prudic et al. 1995).

Eakin (1964) stated that the amount of groundwater in storage within the basin fill and underlying carbonate rocks was relatively large and could provide a reserve for maintaining withdrawal during protracted periods of drought. The exact volume is unknown and depends on the thickness and porosity of the sediments. The thickness has been estimated to be between 1,000 and 16,000 feet, while the average porosity may be less than 10 percent. Groundwater storage in the carbonate rocks beneath Kane Springs, Coyote Spring, and Muddy River Springs was estimated by Burbey (1997) at 8.7 million acre-feet. Of this, 80 percent occurs within the Coyote Spring Valley.

The Pahranagat Shear Zone is suggested to be a partial barrier to southward-trending groundwater flow, as evidenced by higher groundwater elevations north of the fault zone (Burbey 1997). The groundwater elevation decreases almost 1,000 feet across the shear zone, based on December 2005 data (Faunt 2006).

Burbey (1997) evaluated hydrogeology and potential for groundwater development in carbonate-rock aquifers in southern Nevada based on depth to water, depth to and thickness of carbonate rocks, and water quality. Based on these criteria, Burbey identified potentially favorable groundwater development areas including eastern Pahranagat and Coyote Spring Valleys, southernmost Delamar Valley and eastern Lower Meadow Valley Wash.

A geochemical and isotopic evaluation was conducted by Thomas et al. 1996 (USGS 1409-C) and updated in 2001 (Thomas et al. 2001, DRI Publication No. 41169). These results indicated that:

- The White River Flow System acts as one continuous carbonate-rock aquifer from Long Valley in the north to Upper Moapa Valley (Muddy River Springs area) in the south.
- The results of the deuterium isotope and geochemical mass-balance model of the White River Flow System are consistent with 53,000 AFY of groundwater flowing out of Coyote Spring Valley to the Muddy River Springs area in Upper Moapa Valley (37,000 AFY) and to the south-southeast in the carbonate-rock aquifer (16,000 AFY).
- The deuterium isotope composition of water discharging from Big Muddy Spring, the largest discharging spring in the Muddy River Springs area, was used to calculate a deuterium water mass-balance budget for the sub-regional flow system. This budget showed that, for a Muddy River Springs area discharge rate of 36,000 AFY, the sources would be 14,000 AFY of recharge from the Sheep Range, 14,000 AFY of inflow from Pahranagat Valley, and 8,000 AFY of inflow from the Lower Meadow Valley Wash-Kane Springs Valley area.

3.3.3.3 Local Hydrogeology

Recent studies have been conducted to describe the local groundwater conditions in the Kane Springs and Coyote Spring Hydrographic Areas (Burbey 1997; Hydrosystems 2000; CH2MHill 2006; and URS 2006a, 2006b). The local hydrogeology is discussed in the following sections.

3.3.3.3.1 Kane Springs Valley

In the Kane Springs Valley Hydrographic Basin, groundwater occurs principally in the deep fractured rock aquifer, which includes primarily volcanic and carbonate material. The basin-fill deposits in the Kane Springs Valley are the products of the erosion of the surrounding mountains, which are mainly volcanic in origin. These volcanic rocks readily weather to fine-textured sediments (silt and clay). Such sediments typically have low values of hydraulic conductivity, inhibiting the flow of water. As a result, the basin-fill deposits are generally not favorable for the development of laterally continuous aquifer units, although these deposits are undoubtedly locally saturated over some depth interval at least seasonally. Thickness of basin-fill deposits in Kane Springs Valley is approximately 200 feet (URS 2006, Hydrosystems 2000).

The fractured-rock groundwater medium in Kane Springs Valley is composed of both local volcanic and regionally occurring carbonate rocks. Volcanic rocks of the Clover and Delamar Mountains, which are composed of various ash-flow tuffs, rhyolite and basalt, typically do not support development of a significant aquifer system because of heterogeneous intrinsic permeability and the general lack of continuous faulting and folding structures. Fractured and faulted volcanic rocks, however, do provide local conduits for groundwater to recharge into the deeper (carbonate) aquifer system.

Inflow to Kane Springs Valley from the Delamar Mountains, and the area to the northeast is influenced by both the Willow Springs Fault and the presence of a large volcanic caldera complex in the subsurface of the central portion of the valley (Page et al. 2005). Page's maps show the presence of extensive Paleozoic carbonate units south of the Kane Springs caldera that could serve as conduits for groundwater flow. In addition, the high transmissivity for the KPW-1 well discussed below indicates that the Willow Springs Fault is highly conducive to groundwater flow.

Carbonate rocks, which are highly fractured and laterally/vertically continuous, are the primary groundwater media in Kane Springs Valley and provide the principal means of inter-basin groundwater flow from Kane Springs Valley. In the lower portion of the Kane Springs Valley, carbonate rock units are estimated to be more than 16,000 feet thick (CH2MHILL 2006). The test well discussed in the next paragraph (KPW-1) was drilled to a depth of 2,000 feet bgs and encountered fractured carbonate between 1,400 and 2,000 feet bgs (URS 2006a).

To evaluate aquifer characteristics and potential for groundwater development of the fractured carbonate rock in the Kane Springs Valley, LCWD drilled a production/test well (KPW-1) and a monitor well (KMW-1) in the south end of the Kane Springs Valley Hydrographic Basin. The wells are located at an elevation of 2,870 feet above mean sea level (amsl). The geologic setting for KMW-1 well is shown in **Figure 3-4**. The figure also illustrates the depth to carbonate groundwater in the area.

Depth to water in KPW-1 and KMW-1 in January 2006 was measured at 992 and 997 feet bgs, respectively. Two values of transmissivity were determined based on the results of aquifer testing. Results from 7-day sustained aquifer test pumping, including the various methods of aquifer test analysis, are summarized in detail in CH2MHILL (2006). Based on these results, the transmissivity representing the "regional" aquifer varied between approximately 30,000 and 80,000 gallons per day per foot (gpd/ft), and the transmissivity for the zone associated with the local Willow Springs Fault was estimated to be on the order of 300,000 gpd/ft (URS 2006b). Using the screen length of the well (1,025 feet) to represent the aquifer thickness and an average transmissivity of 50,000 gpd/ft, hydraulic conductivity is calculated at 6.5 ft/day (URS 2006b).

In general, hydraulic conductivities of carbonate rocks vary greatly depending on the matrix, small and large fractures, and fault zones. Generally, permeability is greater where there are large openings or fault zones. Dettinger et al. (1995) reported hydraulic conductivities from 39 fractured carbonate rock wells in southern and eastern Nevada with ranges from 0.01 to 940 ft/day. Thus the value of 6.5 ft/day, determined for well KPW-1, is consistent with previous measurements.

Additionally, review of water levels combined with aquifer testing suggests that the Kane Springs Wash fault zone extending southward into the Coyote Spring Valley likely impedes, but does not inhibit, the flow across the fault zone and has the potential to limit the impacts from pumping wells as a function of distance from the fault (CH2MHILL 2006).

Groundwater in the deep carbonate aquifer flows from north to south across the study area, specifically from Pahranagat Valley and Kane Springs Valley into Coyote Spring Valley, and into the Muddy River Springs Area (CH2MHILL 2006).

Groundwater flow through Kane Springs Valley was approximated by CH2MHILL (2006) using the transmissivity values from aquifer testing and an estimated regional horizontal hydraulic gradient that would represent regional gradient driving the flow into the basin. CH2MHILL estimated that the regional groundwater flow into the Kane Springs Valley to be 13,000 AFY. Eestimated local recharge within the Kane Springs Valley is to be on the order of 5,000 AFY. Consequently, the total groundwater inflow to Kane Springs Valley was estimated at 18,000 AFY. Groundwater discharge from Kane Springs Valley into the Coyote Spring Valley was estimated at 16,000 AFY (CH2MHILL 2006).

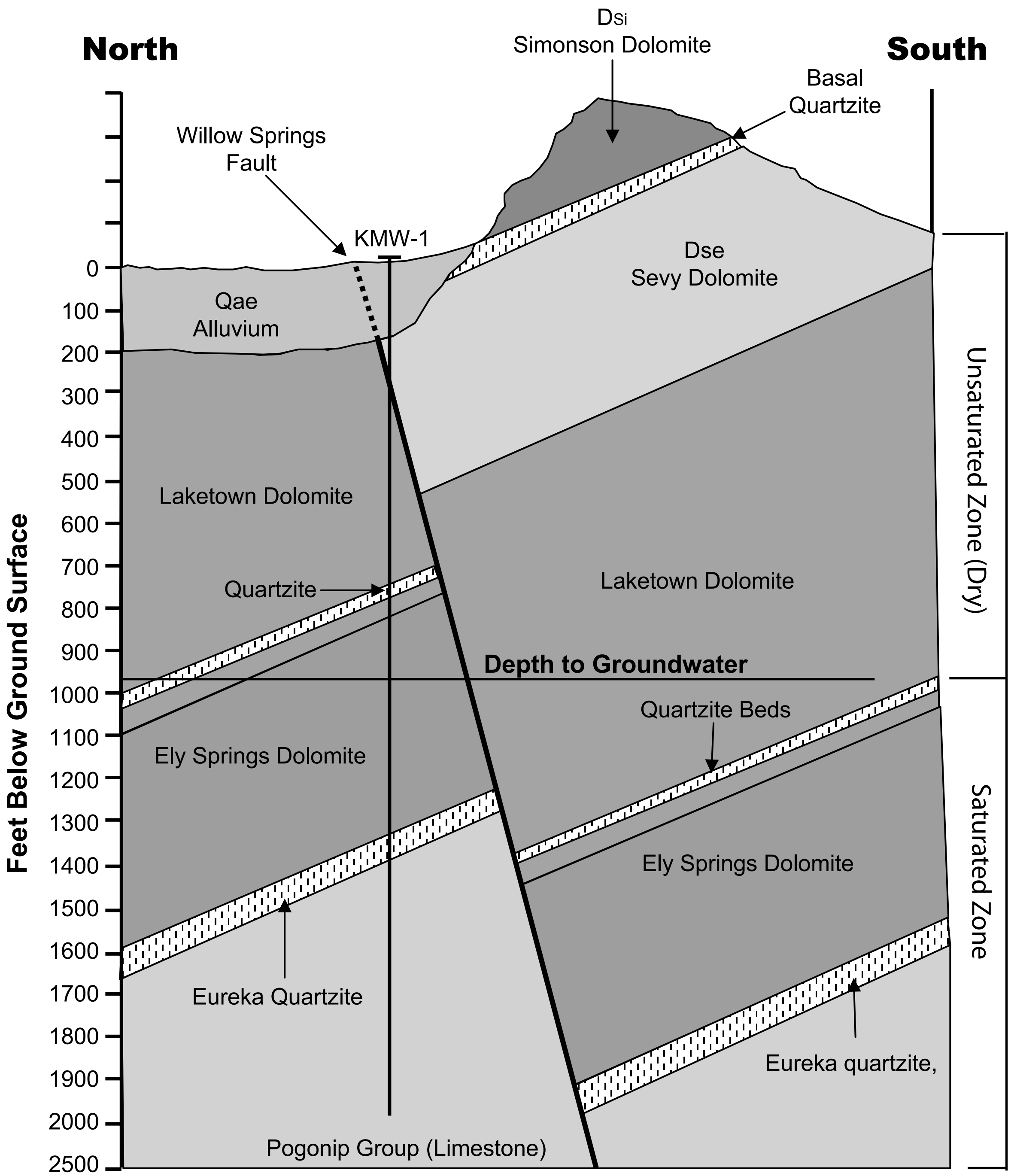


Figure 3-4
Localized Cross-Section
Through KMW-1, Kane Springs Valley

Kane Springs Valley
Groundwater Development Project

Not To Scale
Source: CH2MHILL, 2006

The CH2MHILL (2006) study also concluded that at least 15,000 AFY flow through the aquifer system of Kane Springs Valley Hydrographic Basin, and the perennial yield is on the order of 5,000 AFY based on the recharge analysis developed by Walker. These results are appreciably higher than the earlier estimate of 35 AFY for the shallow inter-basin flow (USGS 1971) and total recharge to Kane Springs and Coyote Spring of 2,600 AFY (Eakin 1966).

Following extensive hearings and review of both the older and newly acquired data, the Nevada State Engineer permitted up to 1,000 AFY of groundwater from Kane Springs Valley (February 2007, Ruling 5712). The text of the ruling provides additional information on the hydrology of Kane Springs Valley. The ramifications of this recent ruling for the Proposed Action are dicussed further in Section 4.3.

3.3.3.3.2 Coyote Spring Valley

Aquifer systems present in Coyote Spring Valley include basin-fill deposits, volcanic and the carbonate-rock aquifer. The basin-fill aquifer in the area is composed of poorly graded interbedded silty clays and light tan to brown sands with gravels. Basin fill directly overlies carbonate rocks in most areas, and thicknesses generally range from approximately 70 feet near the edges of the valley to more than 300 feet in the middle (URS 2006a). Volcanic deposits in the area are composed of pale grey to pinkish devitrified tuff with common quartz and felsic phenocrysts. A rather sharp transition from volcanic to carbonate rocks occurs in the northern part of Coyote Spring Valley (Burbey 1997).

The carbonate-rock aquifer is the largest water-bearing formation within the Coyote Spring Valley. It is composed of layered dolostone and limestone with lenses of detrital shale. Thicknesses of carbonate rocks have been measured to be more than 10,000 feet in the Sheep Range, located in the western part of the Coyote Spring Valley (Guth 1981). Depths to water in the fractured carbonate-rock aquifer vary between 430 and 1,084 feet bgs (URS 2006a). Dettinger et al. (1995) reported hydraulic conductivities from two carbonate wells between 630 and 900 ft/day.

Local recharge to groundwater in the Coyote Spring Valley comes from direct precipitation on the surrounding upland areas. This recharge is augmented by deep through-flowing water in carbonate rocks beneath Pahranagat and White River Valleys in the north and Delamar and Kane Springs Valleys in the northeast (Burbey 1997). Discharge from this area is almost entirely by spring discharge at Muddy River Springs, which was estimated by Eakin and Moore (1964, as cited in Burbey 1997) to be 36,000 AFY. Groundwater storage in carbonate rocks beneath Kane Springs, Coyote Spring and Muddy River Springs was estimated by Burbey (1997) at 8.7 million acre-feet. Of this total, about 80 percent occurs within the Coyote Spring Valley.

3.3.3.4 Springs

Several springs of regional importance lie outside of the project area. These include the Muddy Springs, located approximately 28 miles southeast of the project area within the downstream Muddy River Springs Hydrographic Area, and a series of springs that rim the Overton Arm of Lake Mead (including Rogers and Blue Point).

Several studies have been performed to identify the characteristics and source of the water discharging from the springs in southeastern Nevada. Eakin (1964) evaluated the origin of water from the springs by analyzing variations and magnitude of the spring flow and the chemical character of water issuing from principal springs in the area. Based on the fact that the discharge from Muddy River Springs was highly uniform, and chemical water quality was apparently better than that from the basin-fill aquifer, he concluded that the discharge from Muddy River Springs is being supplied from a large regional groundwater system (Eakin 1966).

A modeling study by Prudic et al. (1995) also concluded that groundwater flow to large regional springs, such as Muddy River Springs, is through permeable carbonate rocks that transmit water from distant recharge areas beneath intervening mountains and valleys.

In support of LCWD's water rights applications, CH2MHILL presented an updated version of their geochemical studies to the Nevada State Engineer in April 2006 (CH2MHILL 2006). Information regarding the average percentage of regional carbonate groundwater in local wells and springs based on deuterium isotope mass-balance studies is provided in the CH2MHILL study. The results indicate that 82 percent of the water in well KPW-1 comes from the carbonate aquifer, and 18 percent is from local recharge. At the other extreme, for Rogers and Blue Point Springs, between 39 percent and 50 percent and between 42 percent and 53 percent, respectively, is groundwater from the carbonate aquifer. **Table 3-4** shows the results of the deuterium isotope mass-balance study.

Table 3-4
Average Percent Carbonate Groundwater in Regional Wells and Springs

Well / Spring	Carbonate Water (%)
Pahranagat	60
KPW-1	82
Coyote Spring	55
Garnet	58
Muddy River Springs Area	62
Big Muddy Springs	60
Meadow Valley Wash	38
California Wash	61
Rogers Spring	39 - 50
Blue Point Spring	42 - 53

Source: CH2MHILL 2006

Average annual flow rates monitored by USGS at Muddy Springs (including Warm, Pederson, East Pederson and Muddy) range from 0.21 to 7.77 cfs (USGS 2005a). Total discharge from springs in this area was estimated by Eakin and Moore (1964, as cited in Burbey 1997) to be 36,000 AFY and represents a major component of Muddy River stream flow. Burbey further states that these springs represent the single greatest groundwater discharge point in southern Nevada. The latest study from CH2MHILL (2006) calculates that approximately 62 percent of the water in the Muddy River Springs Area is derived from the regional carbonate aquifer.

3.3.3.5 Groundwater Quality

Historical groundwater quality data from the Kane Springs Valley are limited. No water quality data are available from basin-fill and fractured carbonate rock units. The concentration of total dissolved solids (TDS) provides a general indication of water quality. Water quality data from three wells completed in volcanic rocks indicated relatively good water quality, with TDS concentrations varying between 475 and 715 milligrams per liter (mg/L) (HydroSystems 2000).

In January 2006, eight groundwater wells were sampled by URS to characterize the groundwater quality of basin-fill, volcanic, and carbonate-rock aquifers within Coyote Spring Valley. The analytical results and corresponding drinking water standards are summarized in **Table 3-5.** Extensive testing was also conducted on test well KPW-1 (located in Kane Springs Valley) during the aquifer test.

Table 3-5
Summary of Groundwater Quality Data Groundwater Wells in Coyote Spring Valley

Parameter (mg/L)	Units	CSVM-2	CSVM-3	CSVM-4	CSVM-5	CSVM-6	CSVM-7	CSV-3	CSI-1	Drinking Water Standards
Well source	--	Carbonate	Carbonate	Carbonate	Carbonate	Carbonate	Volcanic	Fill	Carbonate	--
Well Depth	ft bgs	1,425	1,220	2,842	1,783	1,200	610	780	935	--
Depth to Water	ft bgs	748	442	967	1,084	430	445	589	439	--
Bicarbonate	mg/L	190	240	260	20	250	170	170	305	NS
Calcium	mg/L	86	46	ND	45	46	38	51	53.5	NS
Chloride	mg/L	57	29	53	18	35	21	22	37	250 [a]
Fluoride	mg/L	1.5	1.3	**4.6**	0.69	2.2	1.1	0.99	2.02	4
Magnesium	mg/L	31	20	0.82	30	19	15	26	22.6	NS
Potassium	mg/L	15	12	15	NA	14	9.9	NA	11.9	NS
Silica	mg/L	27	44	ND	22	34	35	21	32	NS
Sodium	mg/L	60	71	140	220	73	44	33	80.6	NS
Sulfate	mg/L	210	73	120	52	93	46	55	102	250 [a]
TDS	mg/L	**620**	430	**550**	320	470	300	370	420	500 [a]
Aluminum	mg/L	ND	ND	NA	ND	ND	ND	ND	0.058	0.05-0.2 [a]
Arsenic	mg/L	ND	0.0095	0.005	ND	0.0097	**0.012**	**0.01**	0.015	0.01
Iron	mg/L	**3.3**	NA	NA	NA	**1.9**	NA	NA	**2.94**	0.3 [a]
Nickel	mg/L	NA	NA	NA	ND	NA	NA	ND	ND	NS
Manganese (dissolved)	mg/L	0.047	ND	**0.097**	0.029	0.021	0.037	0.047	NA	0.05 [a]

Notes:
NA – Not Analyzed; a – secondary drinking standard; mg/L – milligrams per liter
ND – Not Detected; bold values represent exceedances; ft/bgs – feet below ground surface
NS – No Standard; TDS – total dissolved solid

In general, the data indicate relatively good water quality from all three aquifers. For depth-specific samples, TDS values in carbonate-rock aquifer ranged from 320 to 620 mg/L, while TDS from basin-fill and volcanic aquifers were both below the federal drinking water standard of 500 mg/L. Fluoride and iron concentrations exceeded the drinking water standards from carbonate-rock aquifer samples, while arsenic was measured at above the drinking water standard in both basin-fill and volcanic rock water samples (URS 2006a). The sample from KPW-1 collected under flowing conditions yielded 46 micrograms per liter (ug/L) of arsenic and a TDS of 653 mg/L. Both of these values exceed their respective EPA primary and secondary drinking water standards.

3.3.4 Water Supply, Use and Water Rights

Nevada water law is set forth in the NRS Chapters 532 through 538. The Nevada Water Resources Division, headed by the Nevada State Engineer, is responsible for the administration and enforcement of Nevada's water law. This includes overseeing the permitting and appropriation, adjudication, distribution and management of the state's surface and groundwater. Nevada water law requires that an Applicant provide evidence of an actual beneficial use for the water right applied for (NRS § 533.035). The Applicant must satisfactorily prove to the Nevada State Engineer that unappropriated water is sufficient for the intended beneficial use with reasonable due diligence including the financial ability to construct a water development Proposed Action (NRS § 533.035).

3.3.4.1 Surface Water

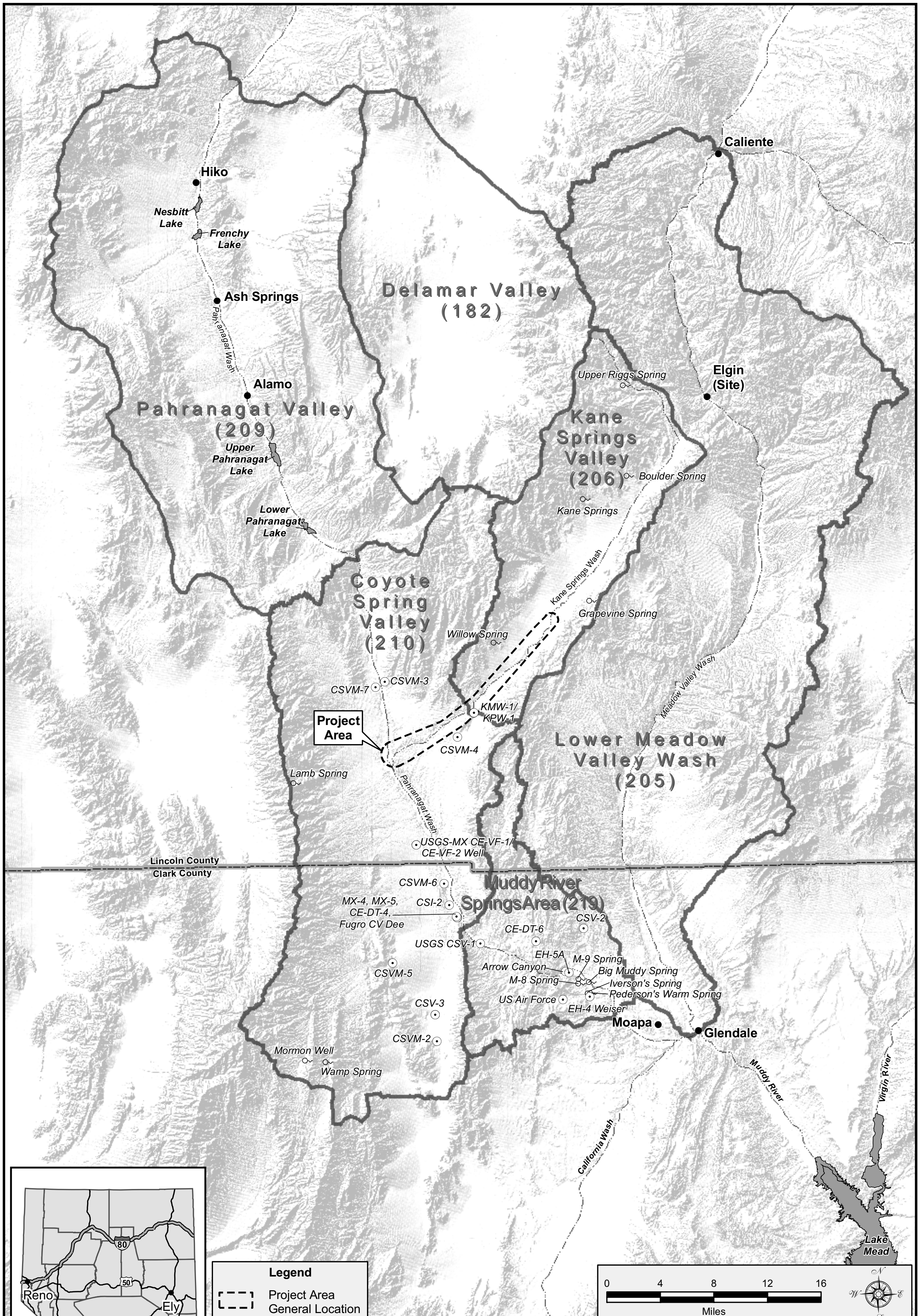
As described in Section 3.3.2.2, with the exception of a few low-flow springs, there is no surface water in the Kane Springs and Coyote Spring Hydrographic Basins. A list of surface water rights within the two basins is provided in **Appendix D**. All surface water rights are certified or vested exclusively for stock water use near springs and dammed reservoirs.

3.3.4.2 Groundwater

Groundwater wells within the Kane Springs Valley and Coyote Spring Valley Hydrographic Basins are associated with municipal, mining, industrial, commercial and irrigation use. Permitted diversion rates for existing wells vary from 0.2 to 10 cfs (145 to 7,242 AFY). Within the Kane Springs Valley Hydrographic Basin, permitted water rights include the recently approved LCWD applications under Ruling 5712. LCWD has an additional four groundwater applications pending before the Nevada State Engineer.

In the Coyote Spring Valley Hydrographic Basin, groundwater rights filed with the Nevada State Engineer include 15 industrial use permits owned by Southern Nevada Water Authority (SNWA), four municipal use permits owned by CSI, one industrial use permit owned by Nevada Power Company, and four permits owned by Bedrock Limited, LLC associated with sand and gravel mining operations. Bedrock Limited, LLC also has one vested application for irrigation use. The locations of water rights in or near the ROI are shown on **Map 3-4**.

There are 34 pending applications by Las Vegas Valley Water District; CSI; Dry Lake Water, LLC; and Bedrock Limited, LLC totaling 202,479 AFY in the Coyote Spring Valley Hydrographic Basin. A list of surface water and groundwater rights in the Kane Springs Valley and Coyote Spring Valley Hydrographic Basins is provided in **Appendix D**.



Kane Springs Valley Groundwater Development Project

Map 3-4

Springs and Wells in the Region of Influence

Date: 03.20.07	File: KaneSprings_Fig_HUC	Author: JAG

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Permitted and pending water rights, as well as estimated perennial yields for hydrographic basins in the ROI and adjacent basins of interest, are summarized in **Table 3-6**. Three of these basins (Lower Meadow Valley Wash, Coyote Spring and Muddy River Springs) are designated basins. The Nevada State Engineer defines designated groundwater basins as "basins where permitted ground water rights approach or exceed the estimated average annual recharge and the water resources are being depleted or require additional administration. Under such conditions, a state's water officials will so designate a groundwater basin and, in the interest of public welfare, declare preferred uses (e.g., municipal and industrial, domestic, agriculture, etc.)."

Table 3-6
Perennial Yield and Water Rights in ROI and Basins of Interest

Hydrographic Basin	Designated Basin	Perennial Yield[1] (AFY)	Water Rights Permitted[3] (AFY)	Water Rights Pending[3] (AFY)
Pahranagat Valley	N	25,000	34,397	52,625
Delamar Valley	N	3,000	7	80,051,543
Lower Meadow Valley Wash	Y	5,000	92,467	20,909
Kane Springs	N	Less than 500	1,000[2]	17,380
Coyote Spring	Y	18,000	35,096	202,479
Muddy River Springs	Y	37,000	40,399	11,587

[1] Nevada State Engineer Ruling 5712 February 2007

[2] Reported diversion rates in cfs were converted to AFY for comparison purposes. However, cfs represents instantaneous measurement that would not be representative of and would likely overestimate a flow rate for the whole year

AFY – acre-feet per year

cfs – cubic feet per second

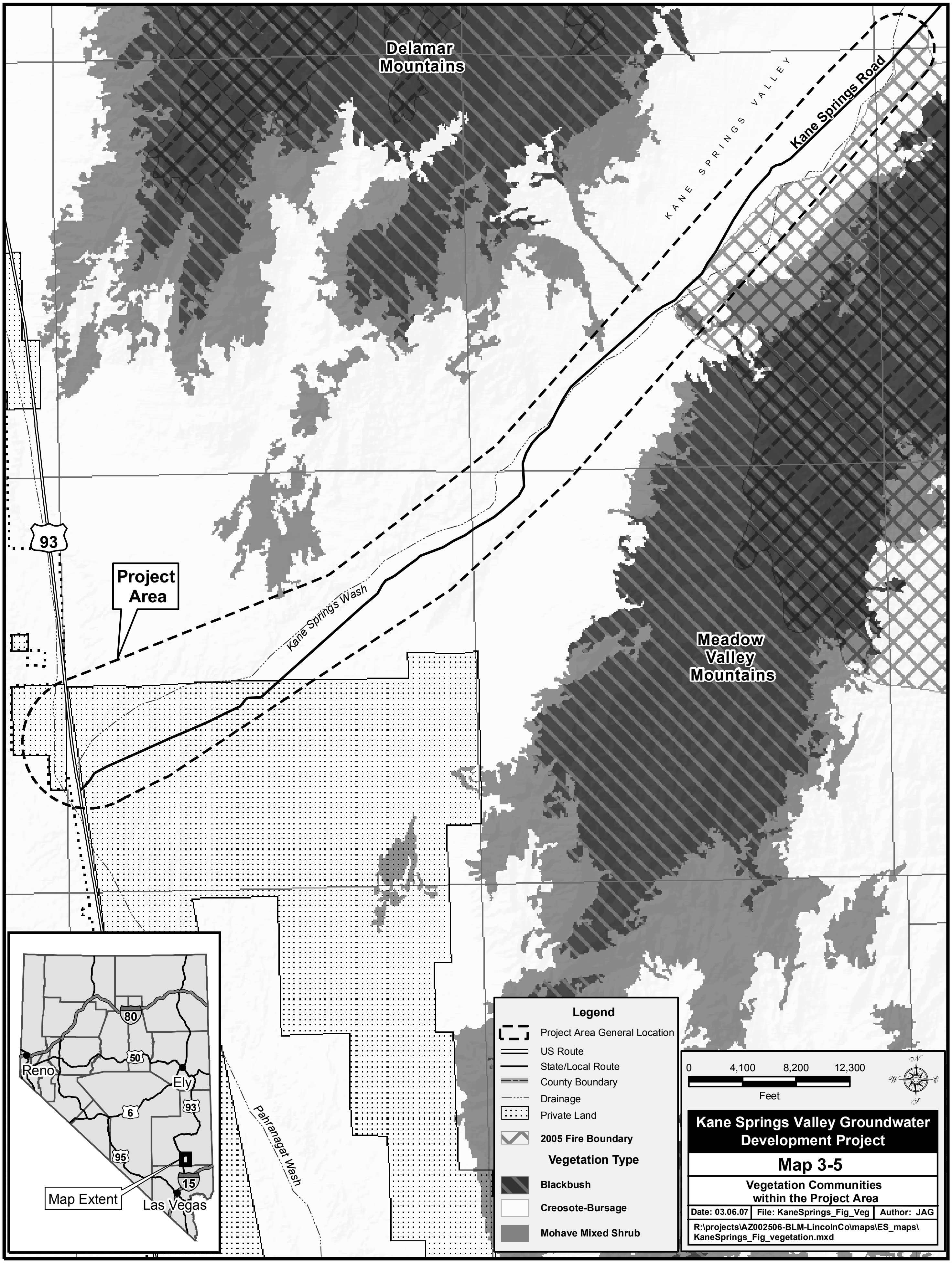
ROI – Region of Influence

3.4 VEGETATION

The project area is located in the Mojave Desert biome, and the ROI for vegetation resources consists of the entire width of the temporary disturbance corridor (100 to 150 feet). Vegetation communities within the Mojave Desert biome that are represented in the project area can be characterized as Mojave Creosote Bush Scrub and Mojave Desert Wash Scrub. Mojave Creosote Bush Scrub communities dominate at elevations lower than 4,000 feet. Mojave Desert Wash Scrub habitat is restricted to sandy arroyos and washes at elevations below 5,000 feet.

3.4.1 Mojave Creosote Bush Scrub

This vegetation class includes Mojave mixed scrub and creosote-bursage vegetation that is dominated by widely spaced shrubs that usually have bare ground between them (**Map 3-5**). Dominant and associate species within this vegetation community are listed in **Table 3-7**.



Delamar Mountains
KANE SPRINGS VALLEY
Kane Springs Road
93
Project Area
Kane Springs Wash
Meadow Valley Mountains
Pahranagat Wash
80
Reno
50
Ely
6
93
95
15
Map Extent
Las Vegas
Legend
Project Area General Location
US Route
State/Local Route
County Boundary
Drainage
Private Land
2005 Fire Boundary
Vegetation Type
Blackbush
Creosote-Bursage
Mohave Mixed Shrub
0 4,100 8,200 12,300
Feet
Kane Springs Valley Groundwater Development Project
Map 3-5
Vegetation Communities within the Project Area
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Author: JAG
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Table 3-7
Dominant and Associate Plant Species in the Mojave Creosote Bush Scrub Vegetation Community

Common Name	Scientific Name
Dominant Species	
Creosote bush	*Larrea tridentata*
Desert thorn	*Lycium* spp.
Shadscale	*Atriplex confertifolia*
Hopsage	*Grayia spinosa*
Blackbrush	*Coleogyne ramosissima*
White brittlebush	*Encelia farinosa*
Bursage	*Ambrosia dumosa*
Desert saltbush	*Atriplex polycarpa*
Associate Species	
Joshua tree	*Yucca brevifolia*
Mojave yucca	*Yucca schidigera*
Engelmann's hedgehog cactus	*Echinocereus engelmannii*
California barrel cactus	*Ferocactus cylindraceus* var. *cylindraceus*
Common fishhook cactus	*Mammilaria tetrancistra*
Beavertail cactus	*Opuntia basilaris*
Silver cholla	*Opuntia echinocarpa*
Diamond cholla	*Opuntia ramosissima*
Mojave prickly-pear	*Opuntia erinacea*
Mormon tea	*Ephedra nevadensis*
Range ratany	*Krameria parvifolia*
Desert trumpet	*Eriogonum inflatum*
Big galleta	*Pleuraphis rigida*
Indian ricegrass	*Achnatherum hymenoides*

This community exhibits a higher susceptibility to large wildland fires compared to other communities in years following high amounts of rainfall. This increased susceptibility is potentially related to the presence of abundant non-native grasses that provide a continuous fuelbed in years following high rainfall (Brooks and Matchett 2006). Additionally, the severity of wildland fires in eastern Nevada has increased in recent years as a result of changes in land use practices (e.g., reduced livestock grazing) and human-caused climate change (BLM 2000). In June 2005, fires burned approximately 8 acres of the ROI in the Meadow Valley portion of the Southern Nevada Complex. A total of 739,000 acres of land in southern Nevada burned over 19 days, with approximately 148,000 acres of the fire occurring in the Meadow Valley portion of the complex, adjacent to Kane Springs Valley. The disturbance caused by fire has allowed for an increased presence of non-native grassland. This non-native grassland provides a more continuous fuel load than that in adjacent unburned areas. Overall, the change from native vegetation, such as scattered shrubs interspersed with forbs, perennial grasses and some succulents, to a non-native annual grassland increases susceptibility of the area to future wildland fires.

3.4.2 Mojave Desert Wash Scrub

The Mojave Desert Wash Scrub community consists of scrubby vegetation, the occurrence of which is restricted to along the borders of Kane Springs Wash and other sandy arroyos. Dominant species of this community within the project area include creosote bush, Mormon tea, and indigo bush (*Psorothamnus fremontii*). Desert willow (*Chilopsis linearis*) and cat claw (*Acacia greggii*) are less common components of this community and are sparse in the project area. Other species that occur in this community type in the project area include desert broom (*Baccharis sarathroides*) and big galleta (*Pleuraphis rigida*). Much of the surface area within this community is bare ground (ARCADIS 2006a).

3.4.3 Non-native Invasive Species and Noxious Weeds

Noxious weeds are defined under Nevada law (NRS 555.005) as any species of plant that is or is likely to be detrimental or destructive and difficult to control or eradicate. Noxious weeds are those weed species that are included on the State of Nevada noxious weed list (NDA 2006). Non-native invasive species are those species that are undesirable and exhibit similar ecological risks as noxious weeds, but are not listed on the federal or Nevada noxious weeds lists.

Related to field studies for this DEIS, biological field crews were tasked to note the presence of noxious and non-native invasive plant species within the project area. Prior to conducting field surveys of the Proposed Action and Alternative 1 alignments, biologists reviewed the Federal Noxious Weed List (USDA 2006), BLM National List of Invasive Weed Species of Concern (BLM 2006b), and Nevada State Noxious Weed List (Invasive.org 2006). Although formal noxious weed inventories were not conducted for the analyses in this DEIS, information from other inventories conducted in nearby areas between 2001 and 2004 located Russian knapweed (*Acroptilon repens*), tamarisk (*Tamarix* spp.), and whitetop (*Cardaria draba*) (BLM 2006a).

Field observations found large populations of cheatgrass (*Bromus tectorum*) in the burn area, which is located in the northeast portion of the project area. This species also occurs sporadically within shrublands throughout the project area (ARCADIS 2006a). Cheatgrass is highly invasive and is the fuel most commonly associated with the chance of ignition and rate of spread of wildland fires in Nevada. The maturation of cheatgrass in the late spring or early summer (as opposed to native grasses, which mature in late summer and early fall) extends the fire season into the hottest months of the year. The dense growth and fine texture of cheatgrass provide for a continuous fuel source to spread wildland fires (Young and Clements 2006).

Non-native grassland occurs in the project area as an understory community within shrublands. This vegetative type also occurs in the area that was affected by the wildland fire in 2005. Dominant grass species include primarily red brome, cheatgrass and Mediterranean grass. The area that was burned in 2005 represents an area of disturbance that favors the spread and establishment of noxious and invasive weed species (Waggoner 2007). Non-native annual grasses increase the risk of fire and often increase in dominance after fire events.

Other common non-native invasive species that may occur in the project area are listed in **Table 3-8**. Of these species, Russian knapweed, perennial pepperweed, salt cedar, whitetop and Sahara mustard are listed on the Nevada Noxious Weed List (NDA 2006).

Table 3-8
Non-Native Invasive Plant Species That May Occur in the Project Area[1]

Common Name	Scientific Name
Red brome	***Bromus rubens***
Cheatgrass	***Bromus tectorum***
Mediterranean grass	***Schismus spp.***
Russian knapweed*	*Acroptilon repens*
Perennial pepperweed*	*Lepidium latifolium*
Whitetop*	*Lepidium draba*
Redstem filaree	*Erodium cicutarium*
Salt cedar*	*Tamarix spp.*
Sahara mustard*	*Brassica tournefortii*
Russian thistle	*Salsola tragus*

[1] Species in bold font are known to occur within the project area. Asterisks designate species that are listed on the Nevada List of Noxious Weeds (NDA 2006)

3.4.4 Federally Threatened, Endangered and Candidate Plant Species

As a component of the ESA Section 7 consultation process, a list of Threatened and Endangered plant species that may occur in or near the project area was obtained from the USFWS on May 16, 2006 (Williams 2006a). This list indicated that no Threatened, Endangered or Candidate plant species were known to occur in or near the project area (**Appendix E-1**).

3.4.5 Special Status Plant Species

For the purposes of this DEIS, special status plant species in the project area include Nevada BLM sensitive species, State of Nevada classified species, and protected species of cactus and yucca. BLM sensitive species exclude taxa that are federally listed, proposed or Candidate species or State of Nevada classified species. BLM policy is to provide these species with the same level of protection as is provided for species that the USFWS lists as Candidate species (BLM Manual 6840.06 C). This level of protection functions to "ensure that actions authorized, funded, or carried out do not contribute to the need for the species to become listed". The sensitive species designation is assigned to species that occur on BLM-administered lands for which BLM has the capability to significantly affect its conservation status through management. The BLM Manual 6840.06 E provides factors by which a native species may be listed as sensitive. These include:

1) Could become endangered or extirpated from a state, or within a significant portion of its range, in the foreseeable future;
2) Is under status review by the USFWS and/or National Marine Fisheries Service;
3) Is undergoing significant current or predicted downward trends in:
    a. Habitat capability that would reduce a species' existing distribution and/or
    b. Population or density such that federally listed, proposed, Candidate, or state listed status may become necessary
4) Typically consists of small and widely dispersed populations;

5) Inhabits ecological refugia, or specialized or unique habitats; or
6) Is state-listed, but may be better conserved through application of BLM sensitive species status.

Forty-six Nevada BLM sensitive plant species were listed (July 2003) as potentially occurring within the BLM district (**Appendix E-2**). Prior to initiating field work conducted by ARCADIS biologists, each of these species was reviewed in coordination with BLM biologists to assess for presence of potential suitable habitat (e.g., soil, elevation, vegetation community associations) within the project area. Twenty-one BLM sensitive plant species were identified as potentially occurring within the project area (see **Table 3-9**). Information on habitat requirements for each of these species (see **Table 3-9**) was obtained from the Nevada Natural Heritage Program Nevada Rare Plant Atlas, Rare Plant Fact Sheets (Nevada Natural Heritage Program 2001).

Table 3-9
Nevada BLM Sensitive Plant Species that May Occur In or Near the Project Area

Common Name (*Scientific Name*)	Habitat
White bearpoppy *Arctomecon merriamii*	On a wide variety of dry to sometimes moist basic soils including alkaline clay and sand, gypsum calcareous alluvial gravels and carbonate rock outcrops.
Meadow Valley sandwort *Arenaria stenomeres*	Carbonate cliffs, ledges, canyon walls and rocky slopes on all aspects above the creosote bush zone.
Eastwood milkweed *Asclepias eastwoodiana*	In open areas on a wide variety of basic (pH usually 8 or higher) soils including calcareous clay knolls, sand, carbonate or basaltic gravels, or shale outcrops, generally barren and lacking competition, frequently in small washes or other moisture-accumulating microsites, in the shadscale, mixed-shrub, sagebrush and lower piñon-juniper zones.
One-leaflet Torrey milkvetch *Astragalus calycosus var. monophyllidius*	Decaying carbonate-derived young soils with sparse vegetation in sagebrush and piñon-juniper communities.
Needle Mountain milkvetch *Astragalus eurylobus*	Generally deep, barren, sandy, gravelly, or clay soils derived from sandstone or siliceous volcanics frequently in or along drainages.
Straw milkvetch *Astragalus lentiginosus var. stramineus*	Deep, loose, sandy soils in washes, flats, roadsides, steep aeolian slopes, and stabilized dune areas with creosote-bursage shrubland in dryer areas and salt cedar-arrowweed communities in wetter washes. Can withstand moderate temporary disturbance. Depends on sand dunes or deep sand.
Halfring milkvetch *Astragalus mojavensis var. hemigyrus*	Carbonate gravels and derivative soils on terraced hills and ledges, open slopes and along washes in the creosote-bursage, blackbrush and mixed shrub zones.
Remote rabbitbrush *Chrysothamanus eremobius*	Crevices or rubble of north-facing carbonate cliffs in and just below the piñon-juniper-sagebrush zone with little leaf mountain mahogany, prickleleaf, three leaf sumac and rock goldenrod.
White River catseye *Cryptantha welshii*	Dry, open, sparsely vegetated outcrops and derived sandy to silty or clay soils of whitish calcareous or carbonate deposits, often forming knolls or gravelly hills, and on soils adjacent to such habitats, mostly in juniper sage rabbitbrush vegetation with various forbs and grasses.

Table 3-9 (continued)
Nevada BLM Sensitive Plant Species That May Occur In or Near the Project Area

Common Name (*Scientific Name*)	Habitat
Las Vegas buckwheat *Eriogonum corymbosum* var. *nilesii*	Gypsum soils, often forming low mounds or outcrops in washes and drainages, or in areas of generally low relief often with California bearpoppy and other gypsum-tolerant species, surrounded by creosote-bursage zone.
Clokey buckwheat *Eriogonum heermannii var. clokeyi*	Carbonate outcrops, talus, scree, and gravelly washes and banks in the creosote-bursage, shadscale saltbush and blackbrush zones.
Scarlet buckwheat *Eriogonum phoeniceum*	White tuffaceous knolls, bluffs and rocky flats; openings in piñon and juniper woodland, with big sage, antelope bitterbrush and rock goldenrod.
Sticky buckwheat *Eriogonum viscidulum*	Deep, loose, sandy soils in washes, flats, roadsides, steep aeolian slopes and stabilized dune areas, with creosote-bursage shrubland in dryer areas and salt cedar-arrowweed communities in wetter washes. Can withstand moderate temporary disturbance. Depends on sand dunes or deep sand.
Pioche blazingstar *Mentzelia argillicola*	Dry, soft, silty clay soils on knolls and slopes with sparse vegetation consisting mainly of pygmy sagebrush, money buckwheat, broom snakeweed and purple sage.
Beaver dam breadroot *Pediomelum castoreum*	Dry, sandy deserts
Beatley scorpion plant *Phacelia beatleyae*	Dry, open, nearly barren scree and loose gravelly soils on slopes and bases of white to brownish volcanic tuff outcrops on all slopes and aspects, and in adjacent drainages, in the mixed-shrub, blackbrush, shadscale saltbush and upper creosote-bursage zones.
Clarke phacelia *Phacelia filiae*	Flat areas or low knolls of valley floors and foothills of desert mountains on light-colored soils including calcareous sandstone, siltstone, tuffaceous claystone and limestone occurring with shadscale saltbush, blackbrush and creosote bush.
Parish phacelia *Phacelia parishii*	Moist to superficially dry, open, flat to hummocky, mostly barren, often salt-crusted silty-clay soils on valley bottom flats, lake deposits and playa edges, often near seepage areas, sometimes on gypsum deposits, surrounded by saltbush scrub vegetation but with few immediate associates such as shadscale, fourwing and silverscale saltbush, Sandberg bluegrass, Nuttall's povertyweed, Fremont's phacelia, yellow pepperweed and greasewood. Aquatic or wetland dependent.
Schlesser pincushion *Sclerocactus schlesseri*	Open, stable or stabilized, gravelly, sandy silt or silty clay soils derived from somewhat ashy and gypsiferous lacustrine sediments, on mesic microsites created and maintained by gentle north to east aspects, dense shrub and grass canopies, high clay and silt content of the soil and cryptobiotic soil crusts, usually associated with such soil crusts in the shadscale zone with the shadscale saltbush and James' galleta association.
Jones globemallow *Sphaeralcea caespitosa*	Dolomite rock calcareous soil, mixed shrub, piñon-juniper and grass community.
Charleston grounddaisy *Townsendia jonesii var. tumulosa*	Open, sparsely vegetated calcareous areas on shallow gravelly carbonate soils on slopes and exposed knolls in forest clearings mostly in the montane conifer zone with ponderosa pine, extending to the piñon-juniper, mountain mahogany and lower subalpine conifer zones, recurring on knolls of white, alkaline, calcareous, silty lacustrine deposits in the upper shadscale/mixed-shrub and lower sagebrush zones.

BLM – Bureau of Land Management

Surveys for special status plant species were conducted throughout all areas within the proposed ROW and including adjacent areas up to 100 feet from the ROW (ARCADIS 2006a). All surveys were conducted during the appropriate flowering seasons (May and September of 2006) by botanists qualified to: (1) assess potential habitat for these species and (2) identify individuals in their vegetative and flowering forms. These surveys indicated that the project area contained suitable habitat for three sensitive plant species - white bearpoppy, Meadow Valley sandwort and Las Vegas buckwheat. However, no individuals of any these three species were located on or adjacent to the project area during surveys of potentially suitable habitat. Overall, no BLM sensitive plant species, state listed plant species or federally listed Threatened or Endangered plant species were found within proposed or alternate ROWs.

All cactus and yucca species that are native to the State of Nevada are protected and regulated by NRS 527.060-120. The field surveys conducted for this DEIS included an inventory of cactus and yucca species occurring within the project area. Cactus and yucca species that occur within the project area include Engelmann's hedgehog cactus (*Echinocereus engelmannii*), California barrel cactus (*Ferocactus cylindraceus* var. *cylindraceus*), common fishhook cactus (*Mammilaria tetrancistra*), beavertail cactus (*Opuntia basilaris*), silver cholla (*Opuntia echinocarpa*), diamond cholla (*O. ramosissima*), Mojave prickly-pear (*Opuntia erinacea*), Joshua tree, and Mojave yucca (ARCADIS 2006a).

3.5 WILDLIFE RESOURCES

The ROI for wildlife resources, including Threatened, Endangered, and Candidate wildlife species, consists of areas that will be affected by permanent and temporary Proposed Action or Alternative 1 features and also those areas where groundwater withdrawal may have an impact on surface waters. The extent of the ROI for wildlife resources is based on the affects on surface waters using the analysis within the Water Resources section of this document. Based on these criteria, the ROI for wildlife resources includes those areas in the immediate vicinity of Proposed Action construction, operations and maintenance activities, as well as the Muddy Springs system, which is approximately 28 miles south of the project area.

3.5.1 Environmental Setting

A wide variety of wildlife resources typical of the Mojave Desert ecological systems are present in the project area. Fish are the only group of vertebrates that are absent from the project area because of the lack of suitable aquatic environments. The vegetation types or communities that comprise the wildlife habitat in the project area include Mojave Creosote Bush Scrub and Mojave Desert Wash Scrub. Surface water sources potentially available to wildlife include isolated springs, stock ponds and wildlife water developments (water sources created specifically for wildlife). **Appendix E-4** provides a list of common wildlife species expected to occur within the project area. The general types of wildlife that occur within the project area are large mammals, small mammals, bats, reptiles, amphibians and birds.

The mountain lion (*Puma concolor*), mule deer (*Odocoileus hemionus*), and Nelson (Desert) bighorn sheep (*Ovis canadensis nelsoni*) utilize all of the mountain ranges around the project area and most likely use or traverse the project area.

Eight big game and 47 small game wildlife water developments are located within 10 miles of the project area. The big game wildlife water developments are located in the Delamar

Mountains and in the Meadow Valley Mountains. The 47 small game wildlife water developments are located predominantly within the Kane Springs Valley and the Coyote Spring Valley (Stevenson 2006).

3.5.2 Federally Threatened, Endangered and Candidate Wildlife Species

As a component of the ESA Section 7 consultation process, a list of Threatened, Endangered, and Candidate species was obtained from the USFWS on May 16, 2006 (Williams 2006a). This list is included as **Appendix E-1** of this document. The USFWS identified three federally listed species and one Candidate species that may occur in or near the project area. These four species are the southwestern willow flycatcher (*Empidonax traillii extimus*) and Moapa dace (*Moapa coriacea*) (both are listed as Endangered), desert tortoise (*Gopherus agassizii*) (Mojave population listed as Threatened), and the yellow-billed cuckoo (*Coccyzus americanus*) (Western Distinct Population Segment - listed as a Candidate species). Desert tortoise is the only species among these four that occurs within the project area. The other three species (southwestern willow flycatcher, Moapa dace and yellow-billed cuckoo) may occur within the ROI for wildlife resources. Information characterizing habitat and populations of each of these species is presented below.

3.5.2.1 Desert Tortoise

The desert tortoise was federally listed as Endangered under emergency provisions of the ESA on August 4, 1989 (54 Federal Register 32326). This listing was modified to include only the Mojave population, and the listing changed to Threatened on April 2, 1990 (55 Federal Register 12178). The desert tortoise is classified as Threatened and protected by the State of Nevada under NAC 503.080.

The desert tortoise is most commonly found within the desert scrub vegetation type where creosote bush scrub occurs, but may also be found in association with succulent scrub, cheesebush (*Hymenoclea salsola* A. Gray var. *salsola)* scrub, blackbush scrub, hopsage scrub, shadscale scrub, microphyll woodland, Mojave saltbush-allscale scrub and scrub-steppe vegetation types of the desert and semi-desert grassland complex (USFWS 1994).

Activity patterns of the desert tortoise are closely related to ambient temperatures and forage availability. They spend much of their lives in burrows and emerge in late winter and early spring to feed and mate. This species remains active through the spring and may emerge again after summer storms. While aboveground, the desert tortoise feeds on herbaceous vegetation, which typically consists of grasses and annual flowers (USFWS 1994).

The USFWS designated 6.4 million acres of critical habitat for the Mojave population of the desert tortoise in 1994. Critical habitat is defined in Section 3 of the ESA as “those areas that have biological or physical features that are essential to the conservation of the species.” Critical habitat is delineated in areas that meet this criterion. The primary constituent elements that are used by the USFWS to identify critical habitat include:

- Space for individual and population growth and for normal behavior;
- Food, water or other nutritional or physiological requirements;

- Cover or shelter;
- Sites for breeding, reproduction and rearing of offspring; and
- Generally, habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species (USFWS 1994).

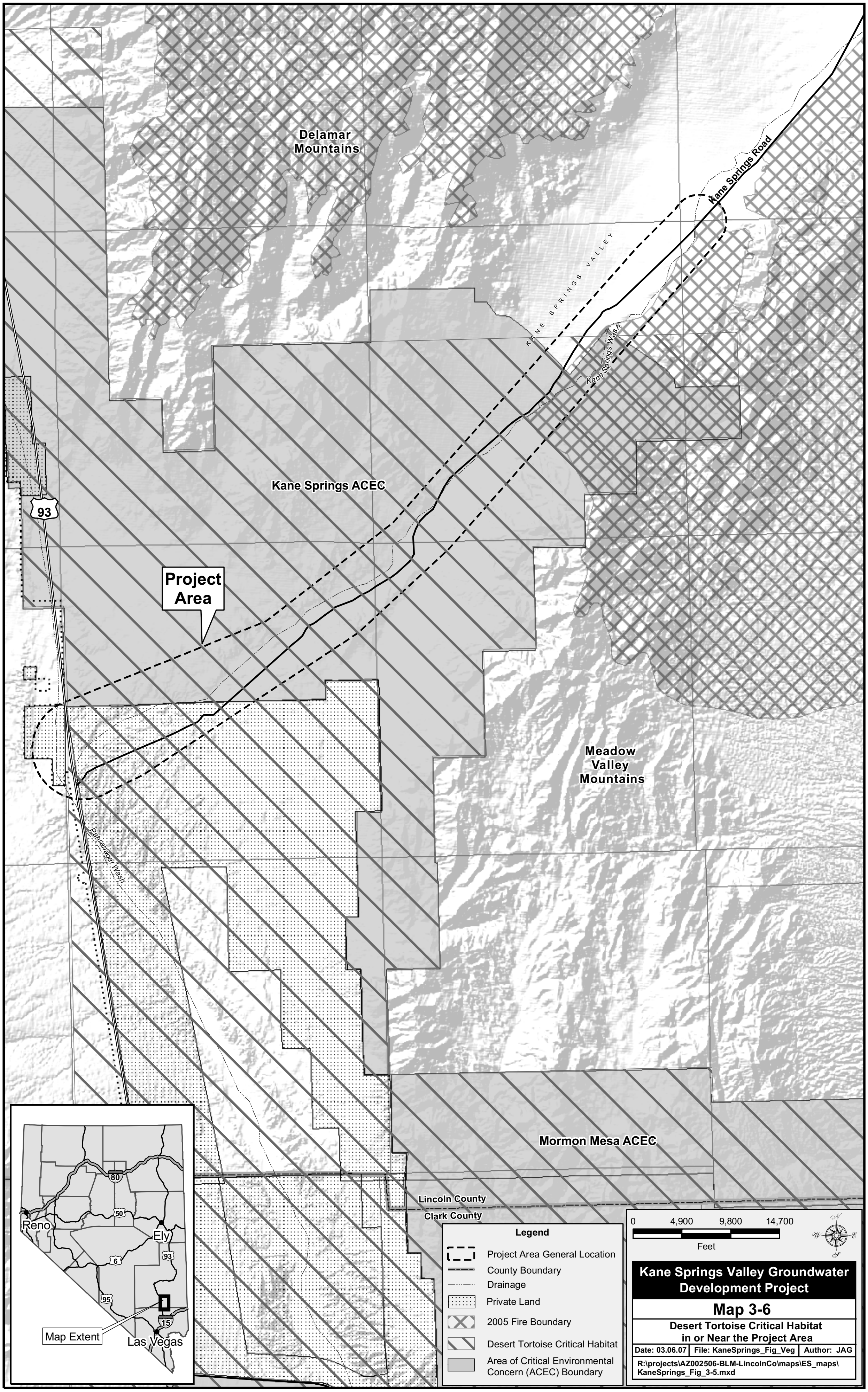
The USFWS used the following primary constituent elements to determine areas that were appropriate to define as critical habitat for the desert tortoise:

- Sufficient space to support viable populations within each of the six recovery units (Western Mojave, Eastern Mojave, Northern Colorado and Eastern Colorado [California]; Northeastern Mojave [Nevada]; and Upper Virgin River [Utah]) and provide for movements, dispersal and gene flow;
- Sufficient quantity and quality of forage species and the proper soil conditions to provide for the growth of such species;
- Suitable substrates for burrowing, nesting and overwintering;
- Burrows, caliche caves and other shelter sites;
- Sufficient vegetation for shelter from temperature extremes and predators; and
- Habitat protected from disturbance and human-caused mortality (USFWS 1994).

In Lincoln County, there are 244,900 acres of designated critical habitat for the desert tortoise. The Mormon Mesa Critical Habitat Unit is composed of three Areas of Critical Environmental Concern (ACECs): Kane Springs, Coyote Spring and Mormon Mesa (USFWS 1994). Portions of the Proposed Action and Alternative 1 occur within designated critical habitat for the desert tortoise (Mormon Mesa Critical Habitat Unit) and the Kane Springs ACEC. In 2005, a wildland fire burned approximately 8 acres within the northeastern third of the project area within the Kane Springs ACEC. Desert tortoise critical habitat in or near the project area is shown on **Map 3-6**.

A desert tortoise survey was conducted by ARCADIS biologists between October 16 and 18, 2006 in the project area. The strip-transect method was used to sample distribution and relative abundance of tortoise sign throughout the project area. Transects were 1.5 miles long by 10 yards wide and were walked in an equilateral triangle with 0.5 mile to a side. Additionally, transects were spaced at 0.5-mile intervals throughout the project area. Surveys found desert tortoises to be distributed relatively evenly along the proposed ROW. However, nearly all sign were inferred (burrows and water scrapes). Direct signs include five observation of scat. No live or dead tortoises were found during the surveys. Estimated densities of desert tortoise ranged from 0 to 26 per square mile. The highest densities occurred in creosote-bursage communities near Highway 93. No evidence of desert tortoise was observed in burned areas (ARCADIS 2006b).

The Proposed Action would occur within the Northeastern Mojave Recovery Unit. Results of rangewide population monitoring (2001 to 2005) indicate that desert tortoise densities were lowest in this recovery unit during the sample period. Population monitoring data are insufficient at this time to determine population trends by recovery unit (USFWS 2006).


Delamar Mountains
Kane Springs Road
KANE SPRINGS VALLEY
Kane Springs Wash
Kane Springs ACEC
93
Project Area
Meadow Valley Mountains
Pahranagat Wash
Mormon Mesa ACEC
Lincoln County
Clark County
Reno
Ely
80
50
6
93
95
15
Map Extent
Las Vegas
Legend
Project Area General Location
County Boundary
Drainage
Private Land
2005 Fire Boundary
Desert Tortoise Critical Habitat
Area of Critical Environmental Concern (ACEC) Boundary
0 4,900 9,800 14,700
Feet
Kane Springs Valley Groundwater Development Project
Map 3-6
Desert Tortoise Critical Habitat in or Near the Project Area
Date: 03.06.07 File: KaneSprings_Fig_Veg Author: JAG
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3.5.2.2 Moapa Dace

The Moapa dace was listed as Endangered on March 11, 1967 (32 Federal Register 4001). The Moapa dace is an endemic species of fish that is restricted to the upper reaches of the Muddy River and associated springs. A survey in 1994 indicated that 3,841 individuals occurred in 6 miles of stream habitat in five thermal headwater spring systems and the main stem of the upper Muddy River in Clark County, Nevada (USFWS 1995b). A 2005 survey of the area estimated that approximately 1,300 individuals inhabited the 5.6 miles of suitable habitat in the Upper Muddy River system. Non-native fish and habitat alterations appear to be the primary reasons for population declines of Moapa dace (Averill-Murray 2007).

Reproduction for this species is restricted to tributary thermal spring outflows with temperatures of 86 to 89.6 °F. Breeding habitat for the Moapa dace exists within the ROI in the Muddy River system, but there is no Moapa dace habitat within the project area. Occupied areas of the Muddy River are approximately 28 miles south of the project area.

3.5.2.3 Southwestern Willow Flycatcher

The southwestern willow flycatcher is a federally listed Endangered bird species that is a neotropical migrant. It winters in Mexico, Central America and possibly northern South America (Sogge et al. 1997). Arizona, southern California, New Mexico, extreme southern portions of Utah and Nevada, and southwestern Texas comprise the majority of the historic and current breeding range of this subspecies. Southwestern willow flycatchers breed between early May and late August and only in dense riparian vegetation near surface water or saturated soil. Nests are generally located in thickets of shrubs or trees that are approximately 6 to 9 feet tall with dense foliage from ground level up to approximately 13 feet (USFWS 2002).

Habitat for the southwestern willow flycatcher includes riparian areas along rivers, streams, or other wetlands with dense growth of willows (*Salix* spp.), arrowweed (*Pluchea sevicea*), and tamarisk (*Tamarix* spp.). Other common plant species associated with nesting habitat include cottonwoods (*Populus* spp.), seepwillow (*Baccharis* spp.), boxelder (*Acer negundo*), stinging nettle (*Urtica* spp.), blackberry (*Rubus* spp.), and Russian olive (*Eleagnus angustifolia*) (USFWS 2002). During migration, this species may be encountered in all but the sparsest of desert habitats.

The southwestern willow flycatcher was listed as Endangered by the USFWS on March 29, 1995. On July 22, 1997 the USFWS designated critical habitat for this species, which was subsequently rescinded by court order. On October 19, 2005, the USFWS again designated critical habitat for the species (70 Federal Register 60886; 74 miles of the Virgin River are part of this critical habitat). The critical habitat unit along the Virgin River is the closest southwestern willow flycatcher critical habitat to the project area.

Habitat for the southwestern willow flycatcher does not occur within the project area. However, habitat for this species does occur within the ROI, and breeding southwestern willow flycatchers occur at Warm Springs Ranch along the Muddy River, approximately 28 miles south of the project area (NDOW 2006). The ROI does not include any critical habitat for the southwestern willow flycatcher.

3.5.2.4 Yellow-billed Cuckoo

The yellow-billed cuckoo is a federal candidate for listing as Threatened or Endangered west of the Rocky Mountains. On July 18, 2001 the USFWS issued a 12-month finding on the petition to list the western yellow-billed cuckoo in the western continental United States. The western yellow-billed cuckoo was placed on the list of Candidate species as a result of higher priorities taking precedence. Western populations of this species have declined due to loss or degradation of up to 90 percent of its riparian habitat.

The historic breeding range of the yellow-billed cuckoo included most of North America from southern Canada to Mexico, but presently is restricted to scattered areas of suitable habitat. This species breeds in large blocks of riparian habitats, particularly woodlands with cottonwoods, willows and dense understory foliage (USFWS 2001). Surveys conducted in the Muddy Springs area identified four breeding pairs of yellow-billed cuckoo at the Warm Springs Ranch, approximately 28 miles south-southeast of the project area. Breeding habitat for this species is lacking within the project area, but breeding habitat does exist within the ROI in the Muddy River system.

3.5.3 Special Status Wildlife Species

A search of the Nevada Natural Heritage Database and the species lists provided by the NDOW and BLM indicated that numerous special status wildlife species may occur in or near the project area. Special status species include Nevada BLM sensitive species as well as State of Nevada classified species, including those listed in the Nevada Wildlife Action Plan. These species are listed in **Appendix E-2** and **E-3**. Species' ranges, habitat preferences and known occurrences within Nevada were determined using information obtained from the BLM, the Nevada Natural Heritage Program (2006), Stebbins (2003), Peterson (1990), Fitzgerald et al. (1994), Gullion et al. (1959), NDOW (2005), and regional biologists (Abele pers. comm.2006a, 2006b, 2006c; Morefield pers. comm.2006a and 2006b).

3.5.3.1 Mammals

Nineteen Nevada BLM sensitive mammal species may occur in or near the project area. These include 15 species of bats, one large mammal, and three small mammals. These may occur in or near the project area (see **Appendix E-2** and **E-3**).

While conducting other biological field surveys in the project area, biologists surveyed for caves or mines that could provide habitat for bats, but no such potential habitat occurred within the project area. However, potential day roosts for bats may exist in the form of cracks and crevasses in rock formations near the project area. In 2004, 11 species of bats were identified during surveys conducted in Meadow Valley Wash, Kane Springs Wash and the Meadow Valley Range (Kenney and Tomlinson 2005). The California myotis (*Myotis californicus*), fringed myotis (*Myotis thysanodes*), western pipistrelle (*Pipistrellus hesperus*), pallid bat (*Antrozous pallidus*), Townsend's big-eared bat (*Corynorhinus townsendii*), long-legged myotis (*Myotis volans*), small-footed myotis (*Myotis ciliolabrum*), big brown bat (*Eptesicus fuscus*), western red bat (*Lasiurus blossevilli*), Yuma myotis (*Myotis yumanensis*), and Brazilian free-tailed bat (*Tadarida brasiliensis*) were detected during these surveys. Within the Kane Springs Wash, seven bat species were detected using an acoustical bat detector. These species included the pallid bat, Townsend's big-eared bat, long-legged myotis, California myotis, small-footed myotis, fringed myotis and western pipistrelle (Kenney and Tomlinson 2005).

Desert bighorn sheep (*Ovis canadensis nelsoni*) occur in mountain ranges surrounding the project area. These populations are managed by NDOW as a big game species. Kane Springs Valley is a movement corridor for desert bighorn sheep among the mountain ranges. The Desert NWR west of the project area is managed by the USFWS primarily for maintaining and improving habitat for desert bighorn sheep.

The desert kangaroo rat (*Dipodomys deserti*), desert valley kangaroo mouse (*Microdipodops megacephalus albiventer*), desert pocket mouse (*Chaetodipus penicillatus*), and Merriam's shrew (*Sorex merriami leucogenys*) are the only special status small mammal species that potentially occur in the project area. No location data are available on these species, but their distribution and range overlaps the project area, and suitable habitat is present within the project area.

3.5.3.2 Reptiles and Amphibians

The banded Gila monster (*Helodermus suspectum*) and the chuckwalla (*Sauromalus [ater] obesus*) are the only two Nevada BLM sensitive species of reptiles that may occur in or near the project area (**Appendix E-2**). The ranges of the banded Gila monster and the chuckwalla overlap the Proposed Action, and suitable habitat for these species occurs in the project area. No surveys were conducted to specifically locate either of these two species, but observations were made while conducting surveys for desert tortoise and rare plants. No individuals of either species were identified during these surveys.

Habitat for the banded Gila monster typically consists of boulders, shrubs and trees that, along with mammal burrows and woodrat nests, provide shelter (Stebbins 2003). This species is the largest carnivorous, and only venomous, lizard in the United States. Due to its rarity in the wild, the banded Gila monster has become highly prized by some collectors, even though collection of this species is illegal. NDOW reports a sighting of a Gila monster in 1988 at Willow Spring and an additional report on the Kane Springs Road 10 to 12 miles northeast of Highway 93 within the last 5 years (Stevenson pers. comm. 2007). This species is rarely active above ground, and thus it is observed infrequently. Potential habitat for the banded Gila monster occurs in the project area, and this species is assumed to occur within the project area in low densities.

The chuckwalla is a large, flat lizard that typically occurs in areas dominated by rocks, boulders, rocky cliff faces, rocky outcrops, lava flows and rocky hillsides and sometimes flat rocky ground (Stebbins 2003). No specific occurrence data were available for the project area. The range of this species overlaps the project area, and suitable habitat exists within the project area. Therefore, it is assumed that this species occurs in the area.

Other species of special status reptiles that potentially occur in the project area include the western banded gecko (*Coleonyx variegatus*), Great Basin collared lizard (*Crotophytus bicinctores*), desert iguana (*Dipsosaurus dorsalis*), long-nosed leopard lizard (*Gambelia wislizenii*), desert horned lizard (*Phrynosoma platyrhinos*), Sonoran lyre snake (*Trimorphodon biscutatus*), long-tailed brush lizard (*Urosaurus graciosus*), and desert night lizard (*Xantusia vigilis vigilis*) (**Appendix E-3**).

The northern leopard frog (*Rana pipiens*) and the Arizona toad (*Bufo microscaphus*) are the only two Nevada BLM sensitive amphibian species that potentially occur in or near the project area. The northern leopard frog does not occur within the project area, but habitat for this species exists in the ROI in the Muddy River system. The Arizona toad is known from the upper reaches of Meadow Valley Wash and is not expected to occur in the project area or ROI.

3.5.3.3 Migratory Birds

All migratory bird species that may occur in the project area, with the exception of rock pigeons (*Columba livia*), house sparrows (*Passer domesticus*), and European starlings (*Sturnus vulgaris*), are protected under the Migratory Bird Treaty Act of 1918 (MBTA), as amended (16 U.S.C. 703-712). The MBTA states that it is unlawful to take, kill or possess migratory birds, their parts, nests and eggs (16 U.S.C. 703-711). For migratory game species, the treaty order is carried out cooperatively with the state agencies (e.g., NDOW), which set and enforce legal harvest laws and regulations. Any impacts to migratory birds are primarily a concern during the breeding season, when most species protected under the MBTA are expected to occur in the project area.

Some typical nesting species of migratory birds that have the potential to occur in the project area are the cactus wren (*Campylorhynchus brunneicapillus*), horned lark (*Eremophila alpestris*), greater roadrunner (*Geococcyx californianus*), ash-throated flycatcher (*Myiarchus cinerascens*), Say's phoebe (*Sayornis saya*), verdin (*Auriparus flaviceps*), loggerhead shrike (*Lanius ludovicianus*), mourning dove (*Zenaida macroura*), and burrowing owl (*Athene cunicularia*). In the more rugged upland and canyon locales, the rock wren (*Salpinctes obsol*) and common raven (*Corvus corax*) can also be considered locally nesting species (Peterson 1990).

Migratory birds occurring within riparian habitats associated with the Muddy River include green heron (*Butorides virescens*), marsh wren (*Cistothorus palustris*), common yellowthroat (*Geothlypis trichas*), blue grosbeak (*Guiraca caerulea*), phainopepla (*Phainopepla nitens*), western tanager (*Piranga ludoviciana*), summer tanager (*Piranga rubra*), vermillion flycatcher (*Pyrocephalus rubinus*), Virginia rail (*Rallus limicola*), and western least bittern (*Ixobrychus exilis*) (Provencher et al. 2005).

Several migratory bird species are considered special status species within the region. The full list of these species is included in **Appendix E-2** and **E-3**. Of these species, the burrowing owl has the highest likelihood of being impacted by the Proposed Action because of its behavior and habitat. Within Nevada, this species occurs in areas dominated by short vegetation where small mammal burrows are available for nesting. Suitable burrows for this species exist in the project area, and one individual was sighted within the project area during other surveys.

3.5.3.4 Fisheries

There is no habitat for fish in the project area. Within the ROI, the Muddy River supports two Nevada BLM sensitive minnow species: the Virgin River chub (*Gila seminuda*) and Moapa speckled dace (*Rhinichthys osculus moapae*). Introduced species known to occur in the Muddy River include mosquitofish (*Gambusia affinis*), shortfin molly (*Poecilia mexicana*), common carp (*Cyprinus carpio*), channel catfish (*Ictalurus punctatus*), largemouth bass (*Micropterus salmoides*), green sunfish (*Lepomis cyanellus*), red shiner (*Cyprinella lutrensis*), fathead minnow

(*Pimephales promelas*), black bullhead (*Ameiurus melas*), golden shiner (*Notemigonus crysoleucas*), rainbow trout (*Oncorhynchus mykiss*), and blue tilapia (*Tilapia aurea*) (USFWS 1995b).

3.5.3.5 Invertebrates

Grated tryonia (*Tryonia clathrata*) and Moapa Warm Spring riffle beetle (*Stenelmis moapa*) are Nevada BLM sensitive species that occur in the Warm Springs area near the Muddy River.

3.6 LAND USE

The ROI evaluated for land use includes the project area and the regional transportation network that would be used during construction and operation of the Proposed Action. Regional transportation routes include Interstate 15 (I-15) and Highway 93. The ROI evaluated for rangeland and livestock grazing includes that portion of the Delamar and Grapevine allotments located adjacent to the Kane Springs Valley Road.

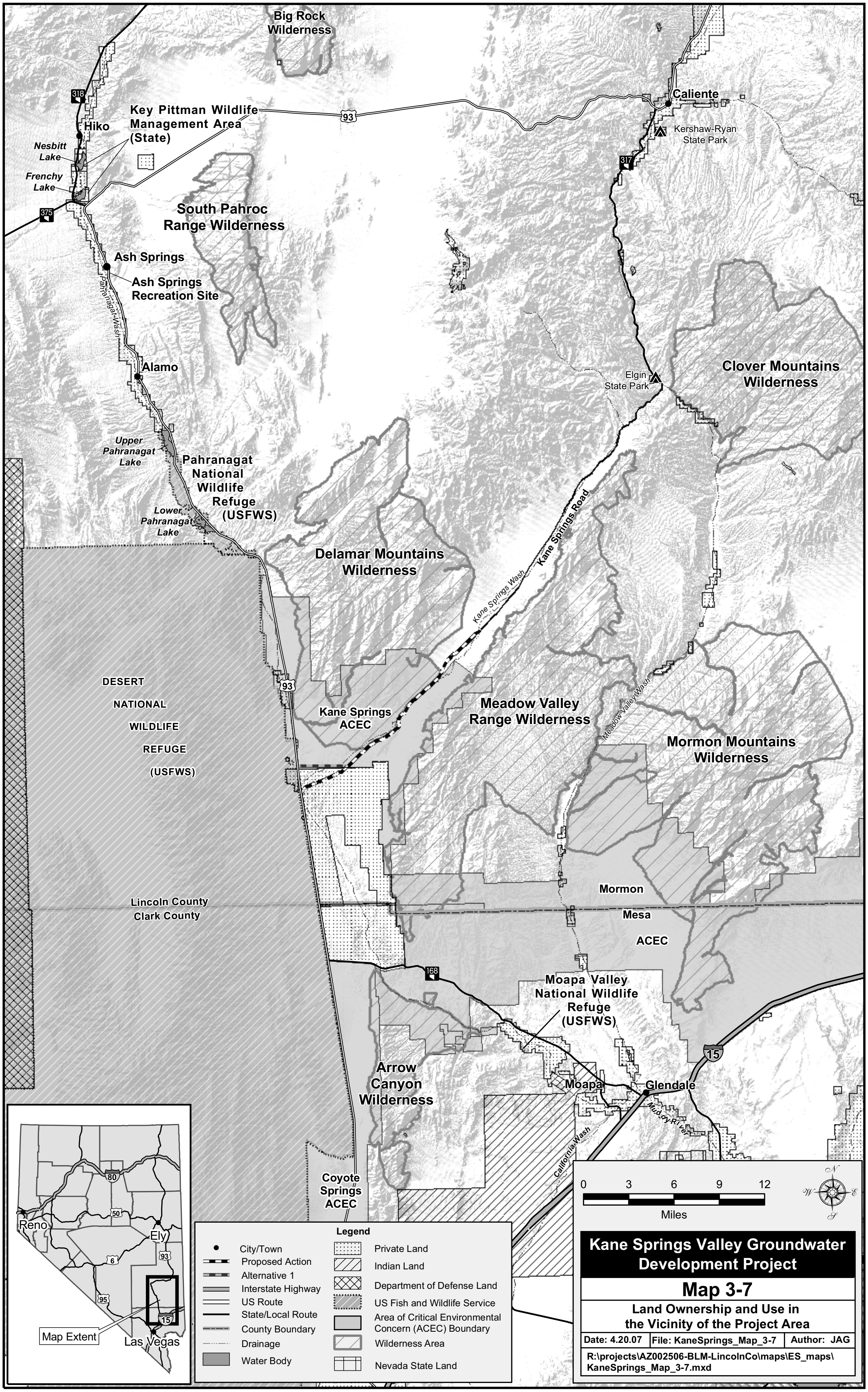
Lincoln County is Nevada's third largest county, encompassing 10,634 square miles (mi^2) in southeastern Nevada. It is bordered by Clark County to the south; Nye County to the west; White Pine County to the north; and to the east by the Utah Counties of Millard, Beaver, Iron and Washington as well as the Arizona County of Mohave. **Map 3-7** shows land status and use in the regional area.

The federal government administers approximately 98 percent of the land in Lincoln County, with the BLM managing approximately 83 percent of total Lincoln County acreage. State lands comprise less than 1 percent of Lincoln County. These lands include the Key Pittman Wildlife Management Area (WMA) near Hiko. Private lands within or adjacent to the project area include those owned by CSI south of the project area and three isolated parcels west of Highway 93. **Table 3-10** lists federal, state, local government and private sector lands in Lincoln County.

Table 3-10
Federal, State, Local Government and Private Lands In Lincoln County

Categories	Acres	Percentage of Total
Federal Agencies		
BLM[1]	5,660,396	83.04
U.S. Forest Service	30,703	0.45
USFWS[1]	785,227	11.52
Other Federal Agencies	223,961	3.29
Total Federal Lands	6,700,287	98.29
State Government	18,802	0.28
Local Government and Private Lands	97,509	1.43
TOTAL	**6,816,598**	**100.00**

[1] BLM and USFWS acreages are approximate and do not include pending land exchanges.
BLM – Bureau of Land Management
USFWS – U.S. Fish and Wildlife Service
Source: Zimmerman and Harris 2001; USFWS 2006


Big Rock Wilderness
Caliente
Kershaw-Ryan State Park
Key Pittman Wildlife Management Area (State)
Hiko
Nesbitt Lake
Frenchy Lake
South Pahroc Range Wilderness
Ash Springs
Ash Springs Recreation Site
Pahranagat Wash
Alamo
Elgin State Park
Clover Mountains Wilderness
Upper Pahranagat Lake
Pahranagat National Wildlife Refuge (USFWS)
Lower Pahranagat Lake
Delamar Mountains Wilderness
Kane Springs Road
Kane Springs Wash
DESERT NATIONAL WILDLIFE REFUGE (USFWS)
Kane Springs ACEC
Meadow Valley Range Wilderness
Meadow Valley Wash
Mormon Mountains Wilderness
Mormon Mesa ACEC
Lincoln County
Clark County
Moapa Valley National Wildlife Refuge (USFWS)
Arrow Canyon Wilderness
Moapa
Glendale
Muddy River
California Wash
Coyote Springs ACEC
Reno
Ely
Las Vegas
Map Extent
Legend
City/Town
Proposed Action
Alternative 1
Interstate Highway
US Route
State/Local Route
County Boundary
Drainage
Water Body
Private Land
Indian Land
Department of Defense Land
US Fish and Wildlife Service
Area of Critical Environmental Concern (ACEC) Boundary
Wilderness Area
Nevada State Land
0 3 6 9 12
Miles
Kane Springs Valley Groundwater Development Project
Map 3-7
Land Ownership and Use in the Vicinity of the Project Area
Date: 4.20.07
File: KaneSprings_Map_3-7
Author: JAG
R:\projects\AZ002506-BLM-LincolnCo\maps\ES_maps\KaneSprings_Map_3-7.mxd

Land use on federal lands adjacent to the project area includes livestock grazing, ROWs for utility infrastructure (such as power, telephone/communication lines and roadways), and special designation areas such as ACECs and Wildernesses. A review of the BLM land records database identified the following approved ROWs near the project area:

- NDOT has a material site in T11S, R63E, Section 31.
- Level 3 has a ROW for a buried fiber optic line along the east side of Highway 93.
- LCPD has a ROW for a power line in T11S, R63E, Sections 20, 21, 29 and 30.
- Idaho Power has a ROW for a transmission line along the east side of Highway 93.
- Lincoln County has a ROW for the old section of Highway 93 that traverses the project area.

The designated LCCRDA utility corridor traverses the project area and is centered primarily along Kane Springs Road. Title III of the LCCRDA established utility corridors for use of electrical, water, gas and other utility transmission across BLM administered lands.

3.6.1 Rangelands and Livestock Grazing

The project area lies within the BLM Caliente Resource Area. All federal livestock grazing allotments within the project area are classified as perennial allotments. Term permits authorize grazing use based on availability of perennial vegetation. The project area crosses two range allotments: Delamar and Grapevine, both of which are cow/calf operations.

These allotments are administered by the BLM Ely Field Office. Information specific to each of these allotments, including their Animal Unit Months (AUMs), is provided in **Table 3-11** (Peterson 2006). An AUM is the amount of forage needed to sustain one cow, five sheep, or five goats for a month.

Table 3-11
Grazing Allotments In or Near the Project Area

Allotment Name	Lessee	Preference Level AUMs	Allotment Acres
Delamar	Delamar Valley Cattle Co.	5,558	203,000
Grapevine	Lewis, Robert and Vivian	560	22,000

AUM – Animal Unit Month

Over recent years, stock levels have fluctuated due to forage availability. In addition, actual use may fluctuate based on environmental and economic conditions. The above average precipitation during the winter of 2004-2005 provided for a substantial increase in annual grass production, which resulted in large wildland fires during the summer of 2005. As a result of these fires, numerous allotments were either closed or partially closed to livestock grazing to aid in rangeland restoration. The Grapevine and Delamar allotments are affected by partial closures of the affected areas due to fire.

3.6.2 Mineral Resources

The State of Nevada, Bureau of Mines and Geology has established various "mining districts" within the state. Mining districts in the region include the Delamar Mining District on the northeast side of the Delamar Mountains; Viola Mining District, located east of Elgin in the Clover Mountains; and Gourd Springs Mining District, located east of the Mormon Mountains. Historic commodities associated with these mining districts included gold, silver, copper and perlite. A review of the BLM's database contains no records of active mining claims, mineral leases or mineral ROWs within the project area (BLM 2006).

Western Elite, Inc. owns and operates a sand and gravel operation on a 560-acre private parcel immediately west of the intersection of Highway 93 and Kane Springs Road. This private parcel was obtained from the federal government on March 12, 1940 under the Pittman Underground Water Act.

3.6.3 Transportation

3.6.3.1 Highways

The primary access to the project area is Kane Springs Road, a county owned and maintained gravel road located east of Highway 93. Vehicular traffic along Kane Springs Road is primarily by local residents and recreational users, including hunters and off-highway vehicle (OHV) users.

Kane Springs Road connects Highway 93 with State Route (SR) 317 at Elgin, a distance of 38 miles. Highway 93 is a major north-south route between Mexico and Canada. I-15 is located approximately 41 miles south of the intersection of Kane Springs Road and Highway 93.

Between Elgin and Caliente, SR 317 parallels the Meadow Valley Wash and the Union Pacific (UP) Railroad. SR 317 experienced extensive road damage from a major flood in 2005. Portions of the road are closed to through traffic at this time.

NDOT operates an automatic traffic recorder (ATR) data site along Highway 93 approximately 12 miles north of the Kane Springs Road at the intersection of Old Corn Creek Road. Historical Annual Average Daily Traffic (AADT) for this site ranges from a low of 1,400 in 1999 to a high of 2,250 in 2000. The last available data in 2005 show an AADT of 1,500. The Level of Service for the portion of Highway 93 between I-15 and Caliente is rated as "A," which indicates a free-flow condition (NDOT 2006).

SR 168 is located approximately 11 miles south of the intersection of Highway 93 and Kane Springs Road in Clark County. SR 168 runs in a southeast-northwest direction, and connects Highway 93 to I-15 through the communities of Moapa and Glendale, a distance of 26 miles.

Numerous gravel and two-track BLM roads parallel and intersect Kane Springs Road between Highway 93 and SR 317. Road system management by the BLM in the Ely District is variable, and priorities for road maintenance are determined on a case-by-case basis. The BLM Ely District has observed an increase in informal travel route proliferation, due mainly to recreation use, which can be correlated to increases in population and OHV use (BLM 2006). OHV activities in the Ely District are managed under the National Management Strategy for Motorized Off-highway Vehicle Use on Public Lands (Executive Orders 11644 and 11989).

NDOT has conducted a transportation study of southern Nevada including Lincoln County (NDOT 2003). The primary goal of the NDOT study was to inventory existing transportation and socioeconomic trends and to forecast these trends over the next 20 years. According to the study, Highway 93 is considered a major regional roadway and is expected to experience steady growth over the next decade. Overall Daily Vehicle Miles traveled in Lincoln County have increased by 32 percent over the 10-year period (NDOT 2003).

3.6.3.2 Union Pacific Railroad

A UP main line runs through the southern part of Nevada, connecting Los Angeles-Long Beach with Salt Lake City and UP's transcontinental line to the east. A section of the southern UP line parallels the Meadow Valley Wash east of the project area and runs along SR 317 south to Elgin, then further south along Carp Road to Moapa.

3.6.3.3 Airports

There are no airports in the project area. The Lincoln County Airport, located just west of Panaca along Highway 93, accepts small, two-engine airplanes. This airport is more than 75 miles north of the project area. There are several dirt airstrips in Lincoln County; however, most of these are not useable or are rarely used (Dixon 2006). The nearest commercial airport is the McCarran International Airport, which is located in Las Vegas.

Large portions of Lincoln County are located in Military Operations Areas associated with the Nellis Air Force Base. The project area is located in the Desert Military Operations Area, which includes the Elgin and Reveille airspaces. Supersonic aircraft operating from Nellis regularly use the airspace during training operations.

3.7 AREAS OF CRITICAL ENVIRONMENTAL CONCERN, WILDERNESS, AND OTHER SPECIAL USE AREAS

The ROI for ACECs, Wildernesses, and other special use areas includes the portions of the project area immediately adjacent to the Delamar Mountains and Meadow Valley Range Wilderness, and the Kane Springs ACEC.

3.7.1 Areas of Critical Environmental Concern

BLM regulations (43 CFR part 1610) define an ACEC as an area "within the public lands where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards." The Caliente MFP (as amended) established three ACECs within the Ely Field District. They include the Kane Springs ACEC (65,900 acres), Mormon Mesa ACEC (109,700 acres), and the Beaver Dam Slope ACEC (36,900 acres). These ACECs were designated and managed primarily for the recovery of desert tortoise (BLM 1999). Habitat for the desert tortoise outside of ACECs is also considered in BLM management decisions with the goal of maintaining or improving existing habitat conditions to stabilize tortoise populations at existing trend levels, improve habitat, and be consistent with recovery efforts by other agencies (BLM 1999).

3.7.2 Wilderness

The Wilderness Act of 1964 created the National Wilderness Preservation System to allow Congress to designate certain public lands as Wilderness "for preservation and protection in their natural condition." Title II of LCCRDA designated approximately 769,611 acres as Wilderness Area within Lincoln County. Adjacent to the project area, portions of both the Delamar Mountains and Meadow Valley Range were designated as Wildernesses with passage of LCCRDA.

The Delamar Mountains Wilderness encompasses 111,328 acres. The Wilderness is partially located in the Kane Springs ACEC.

The Meadow Valley Range Wilderness encompasses 123,488 acres. The Wilderness is partially located in the Kane Springs and Mormon Mesa ACEC. A portion of the Wilderness in Clark County is designed as an "Intensively Managed Area" which is critical to the implementation of the Clark County MSHCP.

3.7.3 National Recreation Areas and National Wildlife Refuges

The closest National Recreation Area is Lake Mead, which is more than 50 miles south of the project area.

The Desert NWR Complex is a protected wildlife refuge, administered by the USFWS and located north of Las Vegas, primarily in Lincoln County. The complex includes the Desert NWR, the Moapa Valley NWR, the Pahranagat NWR, Ash Meadows NWR, and the Amargosa Pupfish Station. Ash Meadows NWR and the Amargosa Pupfish Station are located in Nye County, approximately 90 miles northwest of Las Vegas.

The eastern boundary of the Desert NWR is located immediately west of the project area. The refuge encompasses 1.5 million acres (more than 2,200 mi^2) and includes six major mountain ranges, including the Sheep Range, which forms the western boundary of the Coyote Spring Valley. The refuge is managed by the USFWS primarily for maintaining and improving habitat for desert bighorn sheep. A large portion of the refuge overlaps part of the Nellis Air Force Range. Public Law 99-606, approved November 11, 1986 (100 Stat 3457), provided for the withdrawal of these lands from public use. Military activities on these lands are conducted in accordance with a Memorandum of Agreement (MOA) between the Department of Defense and the USFWS.

The southern reach of the Pahranagat NWR is located approximately 20 miles north of the project area. The refuge is located on 5,380 acres along Highway 93 south of Alamo. The refuge is managed by the USFWS to provide habitat for migratory birds, especially waterfowl. Primary public use consists of wildlife observation, hunting, camping and picnicking.

The Moapa Valley NWR is located northwest of the community of Moapa, south of SR 168. The refuge was established in September 10, 1979 and is managed by the USFWS to secure habitat for the Endangered Moapa dace (USFWS 2006). The refuge is located on 106 acres in northeastern Clark County, approximately 25 miles southeast of the project area.

3.8 RECREATION

The ROI evaluated for effects to recreation resources includes the project area and immediately adjacent areas that may be subject to disturbance from Proposed Action construction.

Most of the recreational use within the area occurs along existing roads that are accessible by passenger vehicle and are within or near designated Wilderness. Existing roadways that provide access into the project area include Highway 93, Kane Springs Road and SR 317.

The mountains and valleys surrounding the project area contain ecologically diverse habitats that offer a range of recreational opportunities. The Meadow Valley Range and Delamar Mountains Wildernesses offer an abundance of dispersed recreational activities such as camping, hiking, climbing, hunting and wildlife viewing. OHV use is limited to existing roads, trails and dry washes.

OHV race events periodically occur on Kane Springs Road. Management of OHV use on BLM lands is guided by the National Management Strategy for Motorized Off-Highway Vehicle Use on Public Lands (Executive Orders 11644 [1972] and 11989 [1978], and regulation 43 CFR 8340). Race activities in the ROI are managed under 43 CFR 8372 and guided by decisions in the Caliente MFP amendment. OHV race events on BLM lands require a Special Recreation Permit from the BLM management office (BLM 2005).

3.8.1 BLM-Designated Recreation Areas

On BLM lands, recreational sites are classified as developed, primitive or dispersed. Developed recreational facilities are those that provide permanent facilities (such as picnic tables and pit toilets), are easily accessible, and are designed to accommodate uses such as camping or picnicking. Primitive and dispersed recreational sites do not have facilities. There are no developed recreational facilities in the project area.

BLM-designated recreation areas include BLM-designated OHV areas and designated recreation areas such as scenic areas, rock hounding areas, natural areas, natural research areas and historic trails. The nearest BLM-designated recreation area is Ash Springs Recreation Site, located approximately 7 miles north of Alamo in the small community of Ash Springs. The developed facility includes a natural hot spring, picnic tables and a vault toilet.

3.8.2 State Parks and Recreation Areas

The nearest state park is the newly designated Elgin Schoolhouse Museum in Elgin, approximately 20 miles northeast of the project area. The restored one-room schoolhouse became Nevada's newest state park in October 2006. Approximately 18 miles north of the Elgin Schoolhouse Museum is Kershaw Ryan State Park. The park, located 2 miles south of Caliente, can be reached from the south via SR 317 and Kane Springs Road and from the north from

Highway 93 south on SR 317. Recreational opportunities include picnicking, hiking trails, photography and nature study (Nevada Division of State Parks 2006).

3.8.3 State Wildlife Management Areas

There are no state WMAs in or near the project area. The closest WMA to the project area is the Key Pittman WMA, which is located approximately 10 miles north of Alamo, off of SR 318 in the Pahranagat Valley. It includes two small lakes: Nesbitt Lake on the north and Frenchy Lake on the south.

3.9 AIR QUALITY

The ROI evaluated for direct effects to air quality includes the project area and immediately adjacent areas that may be subject to disturbance from Proposed Action construction. Indirect effects are evaluated for air quality in the region as a result of the implementation of the Proposed Action or alternatives.

3.9.1 Existing Air Quality

All of Lincoln County is in full attainment of ambient air quality standards; that is, existing background concentrations for all criteria air pollutants are lower than the maximum allowable ambient concentrations under Nevada and national ambient air quality standards. These criteria pollutants include ozone, carbon monoxide (CO), oxides of nitrogen (NO_x), sulfur dioxide (SO_2), particulate matter with mean aerometric diameter smaller than 10 microns (PM_{10}), particulate matter with mean aerometric diameter smaller than 2.5 microns ($PM_{2.5}$), and lead. Units of concentration are expressed in parts per million (ppm) or micrograms per cubic meter (ug/m^3).

The air quality monitoring station closest to the project area is located at the intersection of Highway 93 and I-15 in Clark County (EPA Site 320030022). **Table 3-12** presents PM_{10} concentrations collected at the intersection of Highway 93 and I-15 (Apex) for the years 2002 through 2005. This location is approximately 45 miles south of the project area. The data show that 24-hour concentrations have exceeded the standard several times during this period. Although the Apex area is more industrial than the project area, these readings suggest that the high 24-hour value is related to natural events. For the Las Vegas area, the Clark County Department of Air Quality Management has identified high wind events as being "largely responsible for exceedances of the 24-hour PM_{10} air quality standard" (DAQM 2002). It is likely that these events are also common in the project area.

3.9.2 Areas with Special Air Quality Protection

There are no special air quality protection areas within or near the project area. The closest designated federal Class I air quality area is the Grand Canyon National Park in Arizona, which is more than 100 miles east of the project area. The Lake Mead National Recreation Area is a designated federal Class II air quality area. The northern boundary of the recreational area is more than 50 miles from the project area.

Table 3-12
Intersection of Hwy 93 and I-15 (Apex) PM_{10} Concentrations 2002 - 2005

Year	24-Hour PM_{10} (ug/m³)			Annual PM_{10} (ug/m³)
	Maximum	Day Maximum Recorded	Second Highest	
2002	465	04/15/02	176	26.4
2003	348	10/30/03	105	23.8
2004	150	05/10/04	85	19.1
2005	97	05/16/05	72	18.9

Source: EPA 2006
PM_{10} - particulate matter with mean aerometric diameter smaller than 10 microns
ug/m^3 – micrograms per cubic meter

3.9.3 Existing Stationary Sources of Air Emissions

There are no stationary sources in Lincoln County that emit any criteria pollutant at concentrations higher than 100 ton/yr (major sources). The proposed Toquop Power Plant Project, which would be located southeast of the project area, is currently being reviewed for a major source Prevention of Significant Deterioration air quality construction permit, but this project has not yet been constructed.

3.9.4 Air Quality Regulations

Controlling fugitive dust from construction activities is covered in the NAC 445B.22037 - Emissions of particulate matter: Fugitive dust. A Class II Air Quality Operating Permit for Stand-Alone SAD Permit and a dust control plan are required for surface disturbances of more than 5 acres. The plan must consider "best practical methods" to prevent particulate matter from becoming airborne that include, but are not limited to, paving, chemical stabilization, watering, phased construction and revegetation. The LCWD has prepared a Dust Control Plan as part of its POD submitted to the BLM.

3.10 NOISE

The ROI evaluated for noise includes the project area and those areas immediately adjacent to the project area that may be subject to disturbance from Proposed Action construction and operation.

Sound levels are affected by numerous factors. These factors include a site's general setting (such as isolated, rural, suburban or urban); nature of the noise sources or activities occurring in those settings; proximity of the receptor to the noise source or activity; time of day; and various attenuating factors such as vegetation, topographic features, buildings and atmospheric conditions, that can mute or interrupt noise waves.

Noise standards and sound measurement equipment have been designed to account for the sensitivity of human hearing to different frequencies. This is accomplished by applying "A-Weighted" correction factors. This correction de-emphasizes the very low and very high frequencies of sound in a manner similar to the response of the human ear. The primary assumption is that the A-weighted decibel (dBA) is a good correlation to a human's subjective reaction to noise.

Noise is measured in units of decibels (dB) on a logarithmic scale. Because human hearing is not equally sensitive to all frequencies of sound, certain frequencies are given more "weight." The dBA scale corresponds to the sensitivity range for human hearing. Noise levels capable of being heard by humans are measured in dBA. A noise level change of 3 dBA is barely perceptible to average human hearing. A 5 dBA change in noise level, however, is clearly noticeable. A 10 dBA change in noise level is perceived as a doubling or halving of loudness, while a 20 dBA change is considered a dramatic change in loudness. **Table 3-13** shows noise levels associated with common everyday sources and places the magnitude of noise levels discussed here in context.

Table 3-13
Common Noise Sources and Levels

Noise Source	Average Noise (dBA)
Ambulance siren (100 feet)	100
Typical construction site	85
Single truck (25 feet)	80
Single car (25 feet)	65
Within 100 feet of a highway	60
Normal conversation (5 feet apart)	60
Residential area during day	50
Residential area at night	40
Rural area during day	40
Rural area at night	35
Quiet whisper	30
Threshold of hearing	20

dBA – A-weighted decibel

The project area is a rural, uninhabited area. Average noise levels in rural areas are typically in the 35 to 40 dBA range. Ambient noise in rural areas is commonly made up of natural sounds and vehicle and aircraft traffic. Except for vehicle traffic on rural roads, aircraft and natural sounds, there are few noise-generating sources in the area. The airspace over the project area includes Military Operations Areas associated with the Nellis Air Force Base. Military air traffic generates two types of noise:

- Subsonic flight noise as generated by an aircraft's engines and airframe and
- Sonic booms generated by supersonic flights.

The level of military aircraft sound that is perceived at ground level will depend on the altitude of the aircraft and meteorological conditions. For subsonic flights, the estimated baseline ground level Onset Rate Adjusted Monthly Day-Night Average Sound Levels (L_{dnmr}) for the Elgin and Reveille airspaces to be 47 and 56 dB, respectively (USAF 1999). These values are based on 300,000 sortie-operations. The project area is located in the Desert Military Operations Area which includes the Elgin airspace. The L_{dnmr} metric is based on the rapid ambient sound increase (onset rate) related to aircraft operations. This same study estimated that ground level C-

Weighted Day-Night Sound Level from sonic booms would be 56 dB for the Elgin airspace (30 booms per month) and less than 45 dB for the Reveille airspace (two booms per month).

The project area is subject to the management guidance included in the Caliente MFP (as amended). The Caliente MFP does not contain noise regulations or standards (BLM 1999). Further, Lincoln County currently does not have noise regulations or standards.

3.11 VISUAL RESOURCES

The ROI for visual resources includes areas visible from off-site viewpoints and the viewsheds of the Proposed Action alternatives. The ROI consists of viewsheds from which Proposed Action components would be seen; primarily from higher elevations and public roadways. The ROI is limited in spatial extent to the Kane Springs Valley and portions of the Coyote Spring Valley because the portion of the LCCRDA corridor that would contain Proposed Action facilities is surrounded by mountain ranges that block views of the LCCRDA corridor from sensitive viewing areas located outside of the LCCRDA corridor.

For lands managed by the BLM, Visual Resource Management (VRM) objectives have been developed to protect the most scenic public lands, especially those lands viewed most by the public. The VRM system is the basic tool used by the BLM to inventory and manage visual resources on public lands. VRM classes are objectives that outline the amount of disturbance an area can tolerate before it no longer meets the visual quality of that class. VRM classifications range from Class I, the most restrictive, to Class IV, the least restrictive.

- ***Class I Objective**:* To preserve the existing character of the landscape. The level of change to the characteristic landscape should be low and must not attract attention.
- ***Class II Objective**:* To retain the existing character of the landscape. The level of change to the characteristic landscape should be low.
- ***Class III Objective**:* To partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate.
- ***Class IV Objective**:* To provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high.

3.11.1 Environmental Setting

The topography of southeast Lincoln County is characterized by high mountain ranges with intervening valleys and canyons featuring broad alluvial fans and bajadas. The project area is located along the Kane Springs Valley and Coyote Spring Valley floors that lie between the Delamar Mountain Range on the north, the Meadow Valley Mountain Range on the south, and the Clover Mountains to the northeast. The mountain ranges rise above the valley and provide a scenic backdrop as viewed from Highway 93 and Kane Springs Road. A typical view of the landscape within the project area is shown on the cover of this DEIS.

Evidence of cultural modification in and near the project area includes roads (Highway 93, Kane Springs Road and remnants of old Highway 93), an overhead transmission line and a recently buried fiber optic line along Highway 93, and the Bedrock Limited, LLC facilities west of the intersection of Kane Springs Road and Highway 93.

VRM classes in the vicinity of the project area are aimed at protecting visual resources on public lands in close proximity to the two Wildernesses. Under BLM management in the current Caliente MFP, the LCCRDA corridor is located on lands managed under VRM Class III. The objective of VRM Class III is to provide for management activities that may contrast with the basic landscape elements but remain subordinate to the existing landscape character. Activities may be visually evident, but should not dominate. The nearby Delamar Mountains Wilderness and Meadow Valley Range Wilderness are managed under VRM Class I objectives.

With the creation of the utility corridor in the LCCRDA of 2004 Section 301, the current VRM (Class III) will change to VRM Class IV to fulfill the requirements of the act " ...the Lincoln County Water District nonexclusive rights-of-way to Federal land in Lincoln County and Clark County, Nevada, for any roads, wells, well fields, pipes, pipelines, pump stations, storage facilities, or other facilities and systems that are necessary for the construction and operation of a water conveyance system..." (Winslow 2007).

3.11.2 Key Observation Points

Key Observation Points (KOPs) are critical viewpoints on a travel route, at a use area or potential use area, or in communities where the view of a management activity would be most revealing. KOPs are normally evaluated for proposed actions located in scenic landscapes or where people would be concerned about visual quality of the landscape. KOPs are often selected based on angle of observation, number of viewers, length of time the Proposed Action is in view, relative size of the Proposed Action, season of use and lighting conditions of the area. Some KOPs are located outside of project areas for assessment as an off-site viewpoint of the viewshed. In consultation with BLM staff, one KOP located along Highway 93 near the junction of Kane Springs Road was selected to analyze typical visual impacts that would be experienced by motorists traveling along this route. In general, views from the road would be from moving vehicles.

The KOP provides typical views of the project area landscape to the east as seen by motorists on Highway 93. The landscape east of the Highway 93 consists of rugged terrain in the immediate foreground distance zone (up to 0.5 mile from the viewpoint) that blocks views of the project area; however, the KOP location represents views towards the project area that would be seen by the largest number of people who would have concerns for changes in the existing landscape.

The current landscape that is viewed from the KOP does not contain any significant scenic vistas, features or landforms, and is common to the area; however, the natural setting is an important aspect of the mountainous terrain scattered throughout southern Lincoln County.

In addition to the KOP, views of the project area landscape in the foreground distance zone are available from Kane Springs Road, which provides access to recreational opportunities on BLM lands as well as scenic vistas of both the Meadow Valley Range and Delamar Mountains to travelers on the road. The quality of the visual resource is an important part of the recreational experience for many visitors to public lands and Wilderness areas. The number of viewers is low relative to Highway 93, but the level of concern for individuals traveling the Kane Springs Road for recreational pursuits would be high.

3.12 SOCIOECONOMICS

The ROI for the socioeconomic analysis is Lincoln and Clark Counties, as social and economic effects occur for community and county jurisdictions rather than resource-based areas of influence. The counties are located in the southeast corner of Nevada. Population and labor data are provided for communities located closest to the project area. The nearby Towns of Alamo and Caliente in Lincoln County and Las Vegas in Clark County would provide workers and lodging for the Proposed Action workforce. Demographic data for Nevada are included to set the Proposed Action in a regional context.

3.12.1 Social Characteristics

Most of Nevada's population is located in Clark County (68.8 percent). In 2000, the population of Clark County was 1,375,765, while the population of the State of Nevada was 1,998,257. By 2005, Clark County's estimated population was 1,710,551, a 24.3 percent increase from the year 2000. Of this total, 96 percent live within the urban Las Vegas metropolitan area.

In contrast, Lincoln County's population in 2000 was 4,165, which was less than 0.2 percent of Nevada's population. In 2005, the estimated population of Lincoln County was projected at 4,391, an increase of 5.4 percent. The county's population tends to be concentrated in one incorporated city, Caliente (1,015), and three unincorporated towns: Pioche (698), Panaca (562), and Alamo (428). Together, these four communities account for 61 percent of Lincoln County's estimated 2005 population. The remaining population is settled on isolated private residential areas throughout the county, most immediately located near the aforementioned four communities (Nevada State Demographer's Office 2006a).

As shown in **Table 3-14**, population growth rates in Lincoln County and the communities of Caliente and Alamo were considerably lower than the growth rates for the State of Nevada and for communities in Clark County. North Las Vegas is one of the fastest growing large cities in the nation. The City of Mesquite has also seen high growth rates. In contrast, the economies of Lincoln County have historically been tied to mining and agriculture, and slow population growth rates have reflected the declines of these economic sectors.

The University of Nevada's Center for Economic Development prepared the Analysis of Socio-Economic Data and Trends for Lincoln County to be used for background material for a Comprehensive Economic Development Strategy (CEDS) in Lincoln County and the strategic plan for tourism in Lincoln County (UNR 2004). According to the analysis, Lincoln County's historic dependency on the mining sector and activities at the Nevada Test Site have resulted in unstable population growth rates between 1970 and 2002, indicating the need for economic diversification in the county. The slow growth rate of the county population between 2000 and 2005 (5.43 percent) relative to the growth rate of 52.95 percent in North Las Vegas for the same period is attributed to declines in mining or test site activities. The report further indicates that mining activity accounted for much of the population and economic growth in the 1970s, but declined with the closing of operations at the Bunker Hill Mine and a reduction of the workforce at the Tempiute Mine. Economic and population growth from the 1980s through 2005 resulted from an increase in government and service sector jobs. In addition to reductions in mining, the reduction in agriculture employment is consistent with national trends which reflect fewer small family farms and more mechanization.

Table 3-14
Population Trends in the State of Nevada, Clark County and Lincoln County

Geographic Area	Population (2000)	Population (Estimated 2005)	Percent Change
State of Nevada	1,998,257	2,414,807	20.85%
Clark County	1,375,765	1,710,551	24.33%
Las Vegas	478,434	545,147	13.94%
North Las Vegas	115,488	176,635	52.95%
Mesquite	9,389	13,523	44.03%
Lincoln County	4,165	4,391	5.43%
Caliente	1,123	1,148	2.23%
Alamo	478	428	-10.46%

Source: Nevada State Demographer's Office 2006a

The Nevada State Demographer's population projections estimate that the population of Nevada will have increased by nearly 79 percent between 2005 and 2025. The highest rates of growth are anticipated to occur between 2005 and 2010, as shown in **Table 3-15**. The annual growth rate would be an estimated 4.6 percent between 2005 and 2006, and would decrease annually at a steady rate to 1.3 percent between 2025 and 2026. Lincoln County is projected to have one of the highest growth rates of all Nevada counties between 2005 and 2026, ranking third behind Clark and Lyon Counties. County growth rates are similar to state projections, but are anticipated to decline faster than state rates in that the highest annual growth rate of 4.7 percent would occur between 2005 and 2006, and would decrease to 0.3 percent between 2025 and 2026.

Table 3-15
Population Projections for State of Nevada, Clark County and Lincoln County

Year	Nevada		Clark County		Lincoln County	
	Projected Population	Percent Change	Projected Population	Percent Change	Projected Population	Percent Change
2005[1]	2,518,869	N/A	1,796,380	N/A	3,886	N/A
2010	3,087,428	22.57	2,281,997	27.03	4,754	22.34
2015	3,605,713	16.79	2,718,502	19.13	5,330	12.12
2020	4,001,520	10.98	3,045,813	12.04	5,694	6.83
2025	4,315,334	7.84	3,299,623	8.33	5,875	3.18

[1] The 2005 population is derived from Census 2000 projections, and is not the same as the 2005 estimate provided by the U.S. Census.
N/A – Not Available
Source: Nevada State Demographer's Office 2006b and 2007

The population projections are estimated from historic population trends and do not take into account future probable and foreseeable developments and events. It is likely that actual population growth in Lincoln County would be considerably greater than the population projections shown in **Table 3-15**. Substantial population growth would result from the development of the CSI planned community over the next two to three decades. Other events that could influence population trends are the development of the Lincoln County Land Act (LCLA) parcel north of Mesquite in the southeast corner of Lincoln County.

In 2000, the median age of Lincoln County residents was 38.8 years, which was higher than the 2000 median age of 35.0 in Nevada as a whole and the median age of 34.4 in Clark County. Lincoln County median age increased in 2000 from the 1990 median age of 33.4 years and the 1980 median age of 27.8. These shifts to an increased median age in the county indicate a decrease in the proportionate share of younger age groups. The decrease in the proportionate share of younger age groups in Lincoln County is similar to that of most rural counties in the United States.

According to an economic development strategy analysis prepared by the University of Nevada, rural counties often lose population in age groups 20 to 24 years and 25 to 34 years of age because the young people with the best education, health and the most marketable skills and abilities leave the rural areas to realize greater economic opportunities. In addition to the out-migration of young persons, increased rates of retiree in-migration in recent years has raised concerns that the growing elderly population would require greater levels of public services in a narrowing economy characterized by a shrinking revenue base.

At least part of the reason for Lincoln County's sparse population is that 98 percent of the county's land area is administered by the federal government, and only 1.43 percent is owned by local government or private interests. The two counties can be further compared through a review of the social characteristics of their respective populations in 2000.

Table 3-16 shows population by race in Lincoln County compared with the State of Nevada.

Table 3-16
Population of Race in Lincoln County and Nevada

	Lincoln County	Nevada
White persons, 2004 (a)	95.3%	82.5%
Black persons, 2004 (a)	2.0%	7.5%
American Indian and Alaska Native persons, 2004 (a)	1.9%	1.4%
Asian persons, 2004 (a)	0.4%	5.5%
Native Hawaiians and Other Pacific Islanders, 2004 (a)	0.0%	0.5%
Persons reporting two or more races, 2004	0.3%	2.5%
Persons of Hispanic or Latino origin, 2004 (b)	6.2%	22.8%
White persons, not Hispanic, 2004	89.6%	61.2%

(a) Includes persons reporting only one race.
(b) Hispanics may be of any race, so also are included in applicable race categories.
Source: Source U.S. Census Bureau 2000

In terms of educational attainment, 83 percent of Lincoln County's population 25 years and older had graduated from high school or higher, and 15.1 percent had attained a bachelor's degree or higher. For Clark County, 79.5 percent of the population 25 years and older had graduated from high school or higher, and 17.3 had attained a bachelor's degree or higher.

Lincoln County's population was made up of 19.6 percent civilian veterans, and Clark County's population had 15.6 percent.

The disability status of the population was 21.1 percent and 24.6 percent for Clark and Lincoln Counties, respectively.

Eighteen percent of the Clark County population was foreign-born compared to 3.5 percent in Lincoln County.

Married males made up 52.6 percent of the population older than 15 years in Clark County and 65.7 percent in Lincoln County. Married females older than 15 years made up 52.2 percent of the population in Clark County and 59.4 percent in Lincoln County.

The percent of the population that speaks a language other than English at home was 26 percent in Clark County and 6.1 percent in Lincoln County.

Households with persons 65 years or older totaled 31.9 percent for Lincoln County compared to 21.3 percent in Clark County and 23.4 percent for Nevada (U.S. Census Bureau 2000).

3.12.2 Economic Characteristics

The economy of Lincoln County has historically been supported by mining, agriculture, railroad operations, and federal defense research and development activities. Mining and agriculture have been the dominant economic activities in Lincoln County and continue as a source of income; however, the relative importance of agriculture and mining has decreased in recent decades. Both sectors are still important in the local economy, but constituted a smaller share of employment and personal income sources. The historic economy has also been characterized by the "bust and boom" cycles of a mining economy, as shown by periods of high population growth, no population growth and population declines.

During the late 1970s and early 1980s, mining accounted for approximately 24 percent of the employment and 32 percent of the personal income in Lincoln County. **Table 3-17** summarizes the labor force characteristics of Lincoln and Clark Counties. The table includes data for the State of Nevada to provide a regional context for the county labor force data. Unemployment rates in 2005 have steadily declined from the rates shown for 1990 in **Table 3-17** for Nevada and both counties. The table shows a disproportionately high rate of 7.2 percent for Lincoln County in 1990, which occurred because the county economy had not recovered from the reductions in the mining sector.

While agriculture and mining activity have decreased in Lincoln County, these are still important basic industries, in that they bring money into the county economy through sales to non-local businesses and individuals. The county's agricultural industry produced total cash receipts of $48.5 million in 2003 (most recent available data). Typically, the manufacturing sector is also a fundamental basic industry, as the sector generally provides significant employment and income for the local economy. However, there is currently no manufacturing sector in Lincoln County.

Table 3-17
Labor Force Characteristics of the State of Nevada, Clark County and Lincoln County 2000 through 2005

	Nevada			Clark County			Lincoln County		
Year	**1990**	**2000**	**2005**	**1990**	**2000**	**2005**	**1990**	**2000**	**2005**
Labor Force	655,895	1,062,845	1,215,957	407,763	727,521	862,678	1,464	1,655	1,552
Employment	622,516	1,015,221	1,166,624	387,881	693,933	828,245	1,359	1,573	1,473
Unemployment	33,380	47,624	49,333	19,882	33,588	34,433	105	82	79
Unemployment Rate	5.1	4.5	4.1	4.9	4.6	4	7.2	5	5.1
Source: Nevada Department of Employment, Training, and Rehabilitation 2006a									

Table 3-18 summarizes the number of people employed by all economic sectors in the State of Nevada and Clark and Lincoln Counties in 2005. Clark County's economy is largely service-based, with 865,987 persons employed in private and government sectors. Federal, state, and local governments employed more than 47 percent of the total employed labor force in Lincoln County, which is a strong contrast with total government employment in Clark County (10.0 percent) and Nevada (11.6 percent). This indicates the strong dependence of the local economy on government agencies.

Government jobs at the local level in Lincoln County include those in the City of Caliente, Lincoln County government agencies, the Lincoln County School District, various county General/Special Improvement Districts and the Grover C. Dils Medical Center. State government workers are employed at the Nevada Division of Forestry's honor camp in Pioche, the Caliente Youth Training Center, the Nevada Division of Parks or the NDOT, among others. Federal agencies operating in or near Lincoln County include the U.S. Department of Energy, U.S. Department of Defense and the BLM.

Many sub-sectors of the service economy in Lincoln County are proportionately small when compared with the service sub-sectors in the state and Clark County economies, particularly accommodation and food services, real estate, professional and technical, and health care services. In contrast, employment numbers in the retail trade sectors and the arts, entertainment and recreation services sub-sector indicate that tourism and recreation play a key role in the Lincoln County economy.

Lincoln County employment in the construction sector accounted for less than 2 percent of total county employment, which contrasts with construction employment of more than 11 percent in Clark County and the State of Nevada in 2005. Construction services are generally purchased primarily by local businesses and individuals. The low level of construction activities in Lincoln County relative to the nearby Clark County indicates that the Clark County economy continues to grow while economic growth in Lincoln County is slow.

Table 3-18
Employment by Industry: State of Nevada, Lincoln County and Clark County in 2005

Industry	Nevada		Lincoln County		Clark County	
	Average Employment	Percent of All Industries	Average Employment	Percent of All Industries	Average Employment	Percent of All Industries
Total, All Industries	1,215,739	100.0%	1,268	100.0%	865,987	100.0%
Total Private	1,075,042	88.4%	670	52.8%	779,689	90.0%
Agriculture	2,162	0.2%	26	2.1%	157	0.0%
Mining	10,561	0.9%	20	1.6%	378	0.0%
Utilities	5,046	0.4%	0	0.0%	3,280	0.4%
Construction	134,997	11.1%	17	1.3%	101,550	11.7%
Manufacturing	47,810	3.9%	0	0.0%	24920	2.9%
Wholesale Trade	37,411	3.1%	205	16.2%	22,157	2.6%
Retail Trade	131,913	10.9%	189	14.9%	94156	10.9%
Transportation and Warehousing	40,403	3.3%	6	0.5%	28693	3.3%
Information	14,672	1.2%	23	1.8%	10,420	1.2%
Finance and Insurance	40,182	3.3%	99	7.8%	30,048	3.5%
Real Estate and Rental and Leasing	25,038	2.1%	0	0.0%	19,375	2.2%
Prof. and Technical Services	48,291	4.0%	0	0.0%	33,582	3.9%
Company and Enterprise Mgmt.	11,881	1.0%	0	0.0%	8,589	1.0%
Administrative and Waste Services	85,449	7.0%	17	1.3%	62,833	7.3%
Educational Services	5,894	0.5%	20	1.6%	4,308	0.5%
Health Care and Social Assistance	78,328	6.4%	20	1.6%	53,230	6.1%
Arts, Entertainment, Recreation	29,190	2.4%	90	7.1%	18,135	2.1%
Accommodation and Food Services	298,321	24.5%	82	6.5%	244,525	28.2%
Other Services, Ex. Public Admin	26,506	2.2%	0	0.0%	18,725	2.2%
Unknown Industry	986	0.1%	0	0.0%	631	0.1%
Federal Government	16,785	1.4%	41	3.2%	11,045	1.3%
State Government	31,348	2.6%	134	10.6%	14,208	1.6%
Local Government	92,564	7.6%	424	33.4%	61,045	7.0%

Source: Nevada Department of Employment, Training, and Rehabilitation 2006b

In 2004, total personal income for Lincoln County was $93 million and for Clark County was $54.3 billion. The total personal income for the State of Nevada was $79.5 billion. Dividends, interest, rents and transfer payments in Lincoln County account for a larger percentage of total personal income than in the state or Clark County, which indicates a larger retiree population in Lincoln County.

3.12.3 Housing

The total estimated number of housing units in Lincoln County in 2005 was 2,231 units, an increase of 2.3 percent from the estimated 2,180 housing units in 2000. The growth rate in

Lincoln County was small relative to the growth in housing stock in neighboring Clark County. The number of housing units in Clark County increased by 26.9 percent from 566,107 units in 2000 to 718,358 units in 2005. The slow growth in Lincoln County housing units between 2000 and 2005 indicates that, despite the relatively close proximity of much of Lincoln County to Las Vegas and its surrounding metropolitan communities, there has been very little overflow of the Las Vegas population growth into Lincoln County. The housing stock in Lincoln County and communities within the county was one of the factors contributing to potential economic development analyzed in the 1998 Lincoln County Overall Economic Development Plan (OEDP). The narrowness of the economic base in Lincoln County is exacerbated by the lack of housing, which is one of the primary reasons identified by potential employers as a disincentive to relocate to Lincoln County (Board of Lincoln County Commissioners 1998).

There are no recent data on the availability of rental housing in Lincoln County. However, anecdotal reports indicate that vacant housing of any kind is scarce. In response to the scarce housing stock, Lincoln County has asked the BLM to process the sale of 638 acres near the Town of Alamo for the development of residential uses (Baughman 2006a).

Temporary housing in Lincoln and Clark Counties includes hotels and recreational vehicle (RV) parks in addition to rental housing. Las Vegas and the surrounding metropolitan communities provide numerous motels, hotels and RV parks within about a 1-hour commute of the project area. Alamo, the Lincoln County community nearest to the project area, provides lodging of an estimated 40 to 50 rooms in two motels and many unoccupied hookups in three RV parks (Lincoln County Chamber of Commerce 2006, Baughman 2006b). A new 42-unit subdivision may also provide rentals for temporary housing (Baughman 2006b).

3.12.4 County Services

Lincoln County is largely rural in the southern half of the county with most county services located near the population centers of Alamo, Pioche and Caliente. In Clark County, many of the available county services are located in the greater Las Vegas area and, to a smaller extent, in outlying communities.

Lincoln County services and utilities are provided by a variety of general- and special-purpose districts and private corporations, which provide services such as water, sewer and fire protection at the local level. The districts act independently of county and town boards. The CSI development area has formed a GID that will provide these public services to developments within their planning area.

Fire protection and emergency medical services will be provided for the planning area by the Coyote Spring – Lincoln County Fire Protection and Emergency Medical Service GID. Funds to support the GID would be provided through a property tax levy on private property within the proposed CSI development.

The Lincoln County Office of Emergency Management is responsible for coordinating emergency response for the entire county. In the project area, fire protection services are provided by the Pahranagat Valley Volunteer Fire Protection District (PVVFPD). The PVVFPD encompasses nearly 36 mi^2 in southwest Lincoln County; however, because fire protection services for rural areas of the county are limited, service calls have been made beyond the PVVFPD boundaries for the entire western half of Lincoln County. The Pahranagat Valley Ambulance Association is a unit of the PVVFPD and also provides service to the western half of the county. Law enforcement is provided by the Lincoln County Sheriff's Department (Lincoln County Planning Commission 2006).

Clark County is one of the fastest-growing counties in the nation. With the influx of large populations, the cost of living, including the cost of housing, has skyrocketed in recent years. Clark County offers a program known as "workforce housing." Workforce housing is for low- to moderate-income households that make up to 80 percent of the Area Median Income (AMI) as determined by the U.S. Department of Housing and Urban Development. The AMI for Clark County is $56,550. Many programs are available for affordable housing; however, due to the timeline of Proposed Action construction, these programs may be unsuitable for the Proposed Action workers. Additionally, the project area is located in a rural setting, far from many urban housing options. There are hotels, motels and RV parks that may offer lodging opportunities in Alamo.

3.12.5 Lincoln County Master Plan

The existing Lincoln County Master Plan, adopted in December 2006, guides the county's growth; management of natural resources; provision of public services and facilities; and the protection of the public's health, safety and welfare. Proposed amendments for the Master Plan were developed in 2006 to address growth pressure in the county stimulated by ongoing growth in the Las Vegas area and by proposed large-scale developments in the county. The Master Plan is implemented by its policies, which are directly linked to, and consistent with, the zoning and land division ordinances.

The Master Plan identifies goals and policies for the development of public services and utilities to serve population and housing growth in Lincoln County. The goals for public services and utilities identify the need for such services to serve projected population and housing growth while integrating these services with the existing infrastructure. Policies provide a tool for the implementation of the Master Plan goals. Goals and policies that address public services and utilities, including the provision of water for new developments, are summarized below:

GOAL LUD-3: Public services and facilities should be financed and constructed concurrently with and by new development that will use that infrastructure.

Policy LUD-3A: Lincoln County Public Utilities, in coordination with the Planning Commission and other county agencies, should review all new projects to ensure that new public infrastructure costs directly associated with new development are paid by the new development. Future residential growth should be coordinated with local sewer and water providers, along with electrical and natural gas providers, to ensure that there is adequate capacity.

Policy LUD-3B: Addresses growth corridors, such as the Coyote Spring Valley and the Toquop Planning Area, to ensure that adequate public services and facilities can be provided and financed. Coordinates efforts of this Master Plan with the 1998 Lincoln County OEDP and the 1999 Lincoln County CEDS update.

3.12.6 Lincoln County and Clark County Fiscal Condition

According to the 1998 Lincoln County OEDP, the county government in 1997 was supported primarily by sales and property tax revenues. Intergovernmental revenues accounted for nearly 30 percent of county revenues and consisted of Supplemental City/County Relief Tax (SCCRT) revenue distributions, which accounted for nearly 30 percent of Lincoln County revenues. SCCRT is derived from sales in other counties and is distributed to Lincoln County by the state. The 1998 plan analysis of the 1997 budget concludes that the dependence on intergovernmental revenues by Lincoln County poses a risk to the provision of government services. The lack of significant in-county sales tax revenues is believed to be caused by economic/retail leakage and a narrow commercial/industrial economic base in the county.

The Lincoln County revenue and expenditure balances for Fiscal Years (FYs) 2004 and 2005 are shown in **Table 3-19**. The 2005 budget indicates that the SCCRT revenue distribution of $1.26 million was more than 20 percent of the total 2005 revenues, a decrease of about 10 percent from the 1997 proportion; however, as in 1997, the proportion of intergovernmental resources still accounted for around 60 percent in 2005.

Table 3-19
General Fund Revenues and Expenditures for Lincoln County FY ending 6/30/04 and FY ending 6/30/05

Category	Amount		Percent of Total	
	6/30/04	6/30/05	6/30/04	6/30/05
Revenues				
Property Taxes	1,413,637	1,412,649	15.8%	23.0%
Other Taxes	176,728	37,398	2.0%	0.6%
License & Permits	13,949	11,694	0.2%	0.2%
Intergovernmental Resources	6,327,504	3,645,028	70.7%	59.2%
Charges for services	543,148	495,534	6.1%	8.1%
Fines & Forfeits	340,661	409,741	3.8%	6.7%
Miscellaneous	135,157	133,837	1.5%	2.2%
Total revenues	**8,950,784**	**6,145,881**	**100.0%**	**100.0%**
Expenditures				
General Government	2,152,689	1,200,344	23.8%	17.6%
Judicial	791,809	742,175	8.7%	10.9%
Public Safety	2,354,503	1,721,225	26.0%	25.2%
Public Works	1,456,842	1,652,272	16.1%	24.2%
Sanitation	421,184	186,500	4.6%	2.7%
Health	148,338	164,633	1.6%	2.4%
Welfare	307,765	299,615	3.4%	4.4%
Culture & Recreation	365,692	128,231	4.0%	1.9%
Community Support	362,187	145,946	4.0%	2.1%
Intergovernmental Expenditures	30,487	45,033	0.3%	0.7%
Capital Projects	156,404	482,363	1.7%	7.1%
Debt Service – Principal	513,111	41,900	5.7%	0.6%
Debt Service – Interest	0	18,156	0.0%	0.3%
Total Expenditures	**9,061,011**	**6,828,393**	**100.0%**	**100.0%**
Excess of Revenues over (under) Expenditures	(110,227)	(682,512)		

Source: Nevada Department of Taxation 2006
FY – Fiscal Year

The Clark County revenue and expenditure balances for FYs 2004 and 2005 are shown in **Table 3-20**. The 2005 budget indicates that intergovernmental revenues of $319.3 million were 30.3 percent of the total 2005 revenues, just slightly more than the percentage in 2004 of 29.5.

Table 3-20
General Fund Revenues And Expenditures For Clark County FY Ending 6/30/04 and FY Ending 6/30/05

Category	Amount		Percent of Total	
	6/30/04	6/30/05	6/30/04	6/30/05
Property Taxes	213,130,117	237,128,773	22.9%	22.5%
Other Taxes	n/a	n/a	n/a	n/a
Licenses & Permits	143,686,830	159,868,130	15.5%	15.2%
Intergovernmental Revenue				
CTX[1]	264,091,201	313,642,515	28.4%	29.8%
Other Intergovernmental Revenue	9,934,831	5,683,762	1.1%	0.5%
Total Intergovernmental	274,026,032	319,326,277		
Charges For Services	73,146,892	88,027,159	7.9%	8.4%
Fines & Forfeits	10,153,620	12,916,684	1.1%	1.2%
Miscellaneous Revenues	8,508,057	14,936,081	0.9%	1.4%
Transfers In	206,594,236	219,794,772	22.2%	20.9%
Other Financing Sources	n/a	n/a	n/a	n/a
Total Revenues	929,245,784	1,051,997,876	100%	100%
Beginning Fund Balance	153,723,193	198,691,015		
Total Available Resources	1,082,968,977	1,250,688,891		
General Government	108,303,991	119,894,855	12.2%	12.2%
Judicial	95,814,462	102,130,423	10.8%	10.4%
Public Safety	147,890,711	155,264,446	16.7%	15.8%
Public Works	14,484,674	13,612,688	1.6%	1.4%
Sanitation	n/a	n/a	n/a	n/a
Health	17,141,009	19,900,651	1.9%	2.0%
Welfare	50,819,946	59,479,322	5.7%	6.0%
Culture and Recreation	29,996,265	30,371,153	3.4%	3.1%
Community Support	n/a	n/a	n/a	n/a
Debt Service	n/a	n/a	n/a	n/a
Intergovernmental Expenditures	n/a	n/a	n/a	n/a
Other General Expenditures	55,499,605	63,596,194	6.3%	6.5%
Operating Transfers Out	364,327,299	420,829,521	41.2%	42.7%
Total Expenditures	884,277,962	985,079,253	100%	100%
Ending Fund Balance	198,691,015	265,609,638		
Total	1,082,968,977	1,250,688,891		
Fund Balance as a % of Expenditure	22.5%	27.0%		
Population (as of July 1)	1,715,337	1,796,380		
Revenues Per Capita	542	586		
Expenditures Per Capita	516	548		

Source: Nevada Department of Taxation 2007
n/a – not available
[1] CTX is the acronym for Consolidated Tax which is the consolidation of the Supplemental City-County Relief Tax (SCCRT), Basic City-County Relief Tax (BCCRT), Cigarette Tax, Liquor Tax, Motor Vehicle Privilege Tax (MVPT), and Real Property Transfer Tax (RPTT). The revenues from these taxes are pooled at the county level for distribution to the local governments under a single formula per Chapter 360, Nevada Revised Statues 360.600 through NRS 360.740.
FY – Fiscal Year

3.13 ENVIRONMENTAL JUSTICE

The ROI for analysis of environmental justice is the same as that of the socioeconomic analysis (Lincoln and Clark Counties).

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, states that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." The analysis pursuant to this executive order follows guidelines from the CEQ *Environmental Justice Guidance under the National Environmental Policy Act* (CEQ 1997).

The project area is located in a rural, uninhabited valley. There are no minority or low-income populations in the project area. The community nearest to the project area is the unincorporated Town of Alamo, approximately 10 miles north of the project area. The project area is located approximately 25 miles north of the northern boundary of the Moapa Paiute Reservation. Population and income statistics relative to the project area are described in section 3.12 (Socioeconomics).

3.14 HAZARDOUS MATERIALS AND SOLID WASTES

The ROI for hazardous materials and solid wastes includes the project area and any areas adjacent to the project area subject to disturbance by construction and operation of the Proposed Action and Alternatives including transportation routes for hazardous materials.

3.14.1 Hazardous Materials

Based on a review of EPA and Nevada Department of Environmental Protection (NDEP) databases, there are no uncontrolled hazardous waste sites on or near the project area. There is no evidence of any historical land uses in the project area which might have utilized hazardous materials.

3.14.2 Solid Waste

Western Elite, Inc. operates a 40-acre construction waste facility on a private parcel immediately west of the intersection of Highway 93 and Kane Springs Road. The facility has been operational since 1996 and is classified as a Class III landfill. A Class III landfill is defined in NAC444.571 as a disposal site which accepts only industrial solid waste.

A permitted Class I landfill is in operation approximately 25 miles east of Panaca at Crestline. San Francisco-based Norcal Waste Service is seeking authorization from NDEP to operate a Class I landfill at the Crestline site. Lincoln County has included the proposed new landfill in the current revision of its Solid Waste Management Plan. Lincoln County's Solid Waste Management Plan was adopted in September 2000 and approved by NDEP in August 2001 (Dixon 2006).

3.15 PALEONTOLOGICAL RESOURCES

The ROI for paleontological resources includes the area adjacent to the proposed ROW, nearby off-site areas subject to disturbance from the Proposed Action or Alternatives, and those areas beneath new facilities that would remain inaccessible for the life of the Proposed Action.

Local geological maps and literature were assessed for the potential presence of paleontological resources in the project area. The project area of direct effects is located entirely within Holocene and late Pleistocene alluvial deposits (Swadley et al. 1994). These deposits do not generally contain fossils. An exception may be the presence of Holocene and late Pleistocene vertebrates, charcoal remnants and rodent middens.

Fossil-bearing outcrops of early Permian and late Mississippian beds of limestone, dolomite and sandstone may be exposed in the ROI. These Permian and late Mississippian limestone beds are not exposed in Kane Springs Valley, as the beds are buried with up to 33 feet of Quaternary alluvium. The early Permian and late Mississippian members are estimated to be approximately 3,116 feet thick. These fossil-bearing outcrops are known to contain fossils of corals, brachiopods, bryozoans and gastropods (Webster 1969). Duncan and Gordon (no date) cited in Tschanz and Pampeyan (1970) reported a late Mississippian limestone outcrop near the junction of Kane Springs Wash and Highway 93 that contained fossil *Vesiculophyllum* sp. and crinoid columnals (corals).

During the course of intensive archeological inventory of the APE for the proposed ROW corridor, efforts were made to note surface evidence of paleontological resources. No paleontological remains on the surface were observed; however, buried Holocene and late Pleistocene vertebrates, charcoal remnants and rodent middens may be present.

3.16 ARCHAEOLOGICAL RESOURCES AND HISTORIC PROPERTIES

Extensive investigation of archaeological resources and historic properties has been sparse in southeast Nevada, but new data are being contributed rapidly to better define a culture history for the region. Few stratified sites have been identified, and fewer still have been excavated. Given these limitations, investigators in the region have been forced to rely on a generalized understanding of cultural historical sequences. As a result of these factors, southeastern Nevada remains an area for continuing archaeological and historical research.

The established culture history in the region and associated research domains can be found in the Eastern Nevada, Southern Nevada and Historic Study Units of the Archaeological Element for the Nevada Historic Preservation Plan (Lyneis 1982). Ezzo (1995) provides a revised cultural history of the Moapa and Virgin Valleys in Nevada. The riverine adaptation may have little relevance to the upland Mojave Deseret cultural ecological situation for this Proposed Action. Similarly, the culture history established by Fowler et al. (1973) for the area of upper Meadow Valley Wash and the Pahranagat Valley may not apply well to the extreme xeric environment of Kane Springs Wash. To the west, there is an established cultural historical sequence as a result of research on the Nevada Test Site (Haarklau et al. 2005). To the south, a sequence has been established for the northern margin of the Las Vegas Valley (Ahlstrom and Roberts 2001).

The Nevada Comprehensive Preservation Plan (1989 to present) establishes preservation themes for the historic period in Nevada, many of which are relevant to this region (for example ranching and farming, historic landscapes, the public domain, exploration and early settlements, railroads, and mining). To assess archeological resources and historic properties in the Ely Field District, a probability model developed by Drew and Ingbar (2004) was used to establish a baseline for expected site types and frequencies that may occur in the project area. **Table 3-21** reflects the chronological sequence applicable to the region, associated artifacts and reference citations for previous studies conducted for these resources.

Table 3-21
Cultural Resource Sequence

Time Period	Type Sites/Artifacts	References
Paleoarchaic Period (9500 – 5500 BC)	Tule Springs / Tule Springs and Lake Mojave period lanceolate and stemmed points. Pinto Basin projectile ponts and small cobble manos.	Ahlstrom and Roberts (2001) Grayson (1993)
Middle Archaic (5500 –3000 BC) and Late Archaic (3000 BC – AD 300) Periods	Pinto Basin projectile points, flake choppers, flake scrapers and shallow-basin metates. Gypsum Cave / Gypsum series projectile points. Milling implements (manos and metates) and stone-lined storage bins.	Lyneis (1982) Ahlstrom and Roberts (2001) Harrington (1933) Warren and Crabtree (1986)
Late Prehistoric (AD 300 –1800) and Ethnohistorical (AD 1800 – 1900) Periods	Rose Springs and Cottonwood-series projectile points, a variety of pottery, manos and metates, and storage cists. Basketry sandals, figurines, pipes, bone and horn dishes and spoons, and shaft wrenches.	Ahlstrom and Roberts (2001) Seymour (1997) Fowler (1994)
Historical Period (AD 1540 – 1950)	Artifacts associated with railroads, trails, roads, mines, farms, ranches, homesteads, telegraph and telephone lines, and refuse dumps.	Hafen and Hafen (1954) James (1981) Myrick (1962)

3.16.1 Cultural History

Archaeologists have divided the 12,000-year period during which people have inhabited the Southern Nevada Region into sequences of periods (**Table 3-21**). The division of the time into periods serves several functions. First, they can track changes in the lifeways of the people who inhabited a region in the past. For example, the distinction between the Late Archaic and Late Prehistoric periods is based in part on the introduction of bow-and-arrow technology at the beginning of the later period. Previously, hunters had used an implement called the “atlatl” to propel projectiles known as “darts” at their prey. Second, the periods can reflect the kinds of evidence that are available for studying the past. For example, for all of the periods up through the Late Prehistoric period, the primary evidence for studying the past consists of archaeological remains, whereas for the Historical period, documentary evidence plays the primary role. Third, periods serve as an important aspect of the “historic contexts” that provide the basis for determining if archaeological sites and other historic properties are eligible for the National Register of Historic Places (NRHP, henceforth the National Register). These contexts include the three components of place, time (period), and theme (National Park Service 1986).

3.16.1.1 Paleoarchaic Period (9500 to 5500 BC)

The Paleoarchaic period combines what have previously been referred to separately as the Paleoindian and Early Archaic periods. In geologic time, this combined period corresponds to the end of the Pleistocene and beginning of the Holocene epochs. Great Basin archaeologists generally distinguish two artifact traditions within the Paleoarchaic period: the Clovis (Paleoindian) tradition and the Stemmed Point tradition (Grayson 1993). Data compiled by Willig and Aikens (1988) suggest that the Clovis tradition predated the Stemmed Point tradition by several centuries. Research conducted by Jones et al. (2003) indicates that Paleoarchaic foragers living in the Great Basin obtained obsidian toolstone within “conveyance zones” (areas that were coterminous with the foraging territories of Paleoarchaic populations) that cover a large area in some cases. The project area is likely located within one of these zones, as there are small obsidian nodules spread throughout the valley that likely originated from the Kane Springs Wash volcanic center, which is northeast of the project area. These obsidian nodules would have provided an opportunistic resource for manufacturing stone tools. Chipped obsidian nodules (tested cobbles) identified at several previously recorded sites in Kane Springs Valley suggest that the prehistoric inhabitants were utilizing this resource.

Although Paleoarchaic period sites are extremely rare, one such site (Iola’s Site) is located within Kane Springs Valley. This site is several miles northeast of the project area.

3.16.1.2 Middle Archaic (5500 to 3000 BC) and Late Archaic (3000 BC to AD 300) Periods

The Archaic Tradition is characterized by a broad-spectrum adaptation to the animal and plant resources of a Holocene environment that resembled the Great Basin’s historic and modern-day environment. During the Middle Archaic period, the climate may have been substantially hotter and drier than at present. Characteristic artifacts of the Middle and Late Archaic periods include large projectile points (relative to later arrow points) which would have been hafted to darts that were propelled with atlatls. Grinding tools appear to be an important part of tool assemblages dating to the Middle Archaic, and they are common in Late Archaic assemblages. These tools imply that users had a greater reliance on hard-seed foods in this period than during the Paleoarchaic period.

People of the Middle and Late Archaic period likely traveled through Kane Springs Valley, as it was a natural east-to-west corridor in an otherwise very mountainous region. As in the Paleoarchaic period, obsidian nodules in Kane Springs Valley would have been sought out as a material for stone tool manufacturing.

3.16.1.3 Late Prehistoric (AD 300 to 1800) and Ethnohistorical (AD 1800 to 1900) Periods

The post-AD 300 portion of the Prehistoric period has been referred to as the Late Prehistoric period (Buck et al. 1998), the Late Archaic period (Zeanah et al. 2004), and the Saratoga Springs and Shoshonean periods (Warren and Crabtree 1986). The Late Prehistoric period began with the adoption of the bow and arrow, either as a replacement for or alternative to the atlatl and dart.

Based on arrow point styles, it is possible to divide the Late Prehistoric period into early and late (pre- and post-AD 1200/1300) sub-periods (Warren and Crabtree 1986).

The project area lies just outside the southwestern edge of the area mapped by Madsen and Simms (1998) as representing the maximum extent of the "Fremont Complex." Whereas areas of Fremont occupation are located to the north and east of the project area, a major population center of the Virgin Branch prehistoric puebloans (the Anasazi) is located south of the project area. That center lies in the combined Moapa and Virgin Valleys of southeastern Nevada.

The Late Prehistoric period transforms into the Ethnohistorical period by the early 1800s. The transition is a function of data sources: the Late Prehistoric period is evidenced primarily through archaeological evidence, whereas the Ethnohistorical period is also known from projections backward in time of ethnographic and other accounts from the late nineteenth and early twentieth centuries.

The project area is located in Southern Paiute territory, within the Pahranagat subarea (Kelly and Fowler 1986). The Southern Paiute practiced a hunting and gathering way of life, supplemented to varying degrees from sub-area to sub-area by farming.

3.16.1.4 Historical Period (AD 1540 to 1950)

Although the Spanish entered the Southwest beginning in the 1540s, documentation of direct contact between the Southern Paiute and Europeans did not occur until 1776, when the Spanish priests Francisco Garcės, Francisco Domi̇nguez and Escalante first made contact with the Southern Paiute (Kelly and Fowler 1986). The purpose of this expedition was to establish a route between the New Mexican capital of Santa Fe and the Alta California capital of Monterey.

Euroamericans passed through southern Nevada during the first half of the nineteenth century, but did not settle there. Many used the Virgin River Valley, south of the project area, as a travel corridor, including explorers like Jedediah Smith (in 1826), Antonio Armijo (in 1829), and John C. Frémont (in 1844) (Sterner and Ezzo 1996).

By the late 1850s, Mormon settlements had displaced Southern Paiutes from their traditional agricultural and gathering lands, which became further depleted by livestock grazing and other ranching and farming activities (Kelly and Fowler 1986).

Mining occurred near the project area in the Pahranagat Valley when, in 1865, William H. Raymond moved his mill from California to process the ores in the valley. However, the venture was not successful and as the ores dwindled Raymond and his mining partner, John H. Ely, moved the mill operations to Meadow Valley.

The topography of the region has restricted most transportation corridors to the narrow basins set in between the rugged mountain ranges. One such route includes SR 93, which was constructed in the 1930s. A segment of this highway crosses the project area; however, it was abandoned in the 1960s and rerouted a few miles to the west. The first documented road through Kane Springs Valley was illustrated on the 1881 General Land Office (GLO) survey plat. This historic road was plotted more than 0.5 mile north of the current Kane Springs Road. Because Kane Springs Valley is a natural east-to-west corridor from Coyote Spring Valley to Meadow Valley, it seems likely that trails have existed in this valley since prehistoric times, though none have been documented.

3.16.2 Region of Influence

There has been little previous inventory or evaluation of archaeological resources and historic properties within the APE. The BLM is moving toward the use of watershed-based assessments to identify and analyze archeological resources and historic properties within their jurisdiction (BLM 2005). The Draft Ely RMP/EIS lists 13 categories of archeological resources and historic properties ("site types") that may occur within the management area. **Table 3-22** compares site types known to occur within the region to those that may occur in the APE.

Table 3-22
Archeological Resources and Historic Properties Occurrence within the APE and Region

Parameter	APE	Region
Historic roads, trails, railways, highways, and associated sidings and stations	Historic roads and trails from General Land Office and Wheeler Survey maps. These include the old Highway 93 and the Coyote Spring Roadhouse	Railroad adjacent in Meadow Valley Wash
Rock art sites	None	Kane Springs Rock Art Site
Historic townsites, mining camps, mining districts, buildings and standing structures	None. Gravel extraction at Coyote Spring and perlite extraction in Kane Springs Wash have occurred within the last 50 years.	Delamar Mining District on the northeast side of the Delamar Mountains; Viola Mining District, located east of Elgin in the Clover Mountains; and Gourd Springs Mining District, located east of the Mormon Mountains.
Cemeteries, isolated gravesites/burials	None	Cemeteries may be associated with the historic mining districts listed above.
Ethnic arboreal narratives, graphics, and bow stave trees	None	The margins or uplands of the Kane Springs and Coyote Spring watersheds may contain these resources.
PaleoIndian sites (artifact scatters)	Fluted points have been documented and collected in Kane Springs Wash.	Fluted points have been documented and collected in Kane Springs Wash.
Formative Puebloan Sites (dry masonry structures, pithouses, pits and artifact scatters)	None	None.
Prehistoric Complex Sites, Campsites or specialized activity areas (artifact scatters, storage pits, roasting pits and rock alignments)	None	None

Table 3-22 (continued)
Archeological Resources and Historic Properties Occurrence within the APE and Region

Parameter	APE	Region
Rock shelters and cave sites	None	The margins or uplands of the Kane Springs and Coyote Spring watersheds may contain these resources; however, none have been documented.
Tool stone sources or quarries (lithic scatters)	Isolated occurrence associated with the Kane Springs tool stone sources	Isolated occurrence throughout the region
Ranching and livestock related historic sites, buildings, standing structures and landscapes	Facilities associated with historic water development and homesteading	Facilities associated with historic water development and homesteading
Ethnohistoric sites, sacred sites, traditional use areas and traditional cultural properties	None	None have been identified during previous investigations (Woods 2003) or during Tribal coordination activities.
Other (agave roasting pits, intaglios, geoglyphs, antelope walls, historic debris scatters, non-mining and non-ranching features)	Geoglyphs, such as the Sunflower Mountain geoglyph, may occur on watershed margins in areas that provide views of the surrounding landscape.	Geoglyphs may occur on watershed margins in areas that provide views of the surrounding landscape.

ROI – Region of Influence

A Class I records review conducted for the Proposed Action identified a total of 33 cultural resource studies previously conducted in the area, with a total of 27 sites recorded as occurring within 1 mile of the project area. These sites include 26 prehistoric artifact scatters and one historic highway. Of these, three were previously recorded as occurring within the APE. Two of the sites were recorded as artifact scatters, and the third site (a historic highway) consists of a segment of the old Highway 93.

Not all sites identified in the APE are eligible for listing on the National Register. Previously recorded sites located within the APE are listed in **Table 3-23** below:

Table 3-23 Previously Recorded Sites within the APE			
Site Number	**Jurisdiction**	**Description**	**National Register Eligibility**
26LN3723	BLM Ely Field Office	Historic Highway 93	Not Eligible
26LN2848	BLM Ely Field Office	Prehistoric artifact scatter	Not Eligible
26LN4001	BLM Ely Field Office	Prehistoric artifact scatter	Not Eligible
BLM – Bureau of Land Management			

Consulted Tribes did not identify any cultural significant areas in the ROI (see **Table 3-22** and Section 5.2). Contacted Tribes did not specifically identify any of the other previously recorded archaeological sites as culturally significant.

3.16.3 Area of Project Direct Effects

An intensive pedestrian archeological inventory (Class III survey) was conducted for the Proposed Action in November of 2006 (HRA and ARCADIS 2007). The survey corridor encompassed a 300-foot wide area (725 acres) APE that included: 1) the 60-foot wide permanent ROW, 2) the temporary 75-foot wide construction ROW, and 3) an area of approximately 100 feet by 200 feet that would be needed during construction for equipment storage and ancillary features. The Class III survey identified no new sites and 61 isolated occurrences within the APE. The isolated occurrences consisted of chipped stone debitage/debris from tested obsidian, chert and quartzite cobbles. Of the three previously recorded non-eligible National Register properties identified in the project APE, only old historic Highway 93 (26LN3723) was located during the Class III survey. The sites previously identified as prehistoric artifact scatters (26LN2448 and 26LN4001) were not located, and may be either obliterated or buried as a result of erosional processes, or they may not have been accurately plotted when first recorded.

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